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part II: tree species lists for potential natural vegetation types

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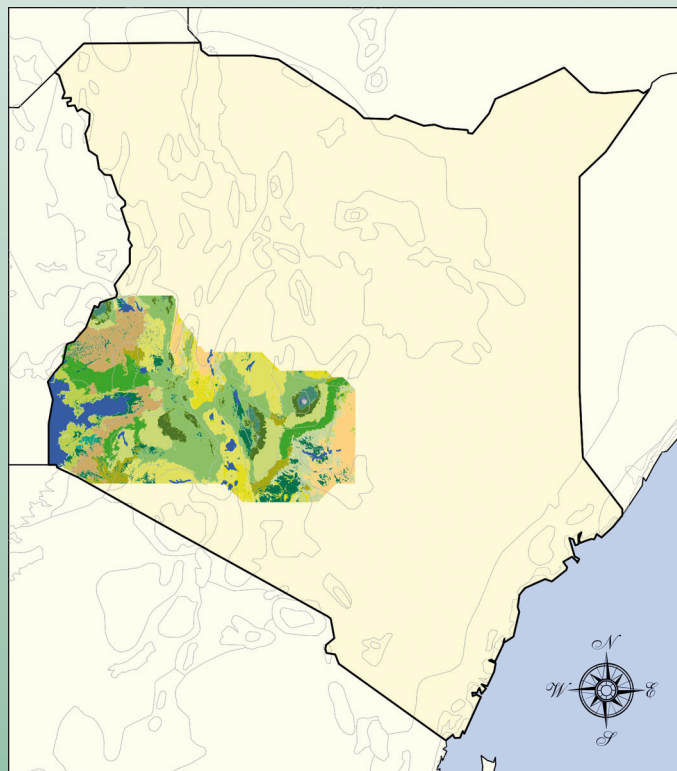
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Use of vegetation maps to infer on the ecological suitability of species using central and western Kenya as an example

Part II: Tree species lists for potential natural vegetation types

***Roeland Kindt, Paulo van Breugel and
Jens-Peter Barnekow Lillesø***



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Roeland Kindt, Paulo van Breugel and Jens-Peter B Lillesø

Title

Use of vegetation maps to infer on the ecological suitability of species using central and western Kenya as an example. Part II. Tree species lists for potential natural vegetation types for entral and western Kenya.

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Front page image

The digitized vegetation map of Southwest Kenya superimposed on the Kenya map (thick lines). The vague lines show the outlines of the vegetation types of White's (1983) vegetation map of Africa.

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Acronyms

ANN	Artificial neural networks
BAM	Bamboo woodland and thicket
BIOMOD	Biodiversity modelling approach, selects the model that provides the best predictions from GLM, GAM, CART and ANN
BM	Bayesian modelling
BP	Bioclimatic profiles, implemented in BIOCLIM software
CART	Classification and regression trees
DA	Discriminant analysis
DCO	Dry <i>Combretum</i> savanna
DIF	Dry Intermediate forest
DMF	Dry Montane forest
EB	Evergreen and semi-evergreen bushland
ENFA	Ecological niche factor analysis, implemented in the BIOMAPPER software
GA	Genetic algorithms; implemented in the desktop-GARP software
GAM	Generalised additive models
GDM	Generalised dissimilarity modelling
GLM	Generalised linear models
IAC	<i>Acacia</i> and allied vegetation on soils with impeded drainage
LAC	Lowland <i>Acacia-Commiphora</i> woodland, bushland and thicket
MCO	Moist <i>Combretum</i> - <i>Terminalia</i> savanna
MD	Mahalanobis distance
ME	Maximum entropy
MIF	Moist intermediate forest
MMF	Moist montane forest
PNV	Potential natural vegetation
SET	Semi-evergreen thicket
SI	Spatial interpolation
UAC	Upland <i>Acacia</i> woodland, savanna and bushland

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1. Introduction

Vegetation maps show classifications of plant communities based on differences in floristics (composition and relative abundances of species), physiognomic structure (such as growth form, height, ground cover, type of leaves) and seasonal activity patterns (van der Maarel 2005, Box and Fujiwara 2005). Potential natural vegetation (PNV) has been defined as the vegetation structure that would become established if all successional sequences were completed without interference by man under the present climatic and edaphic (soil) conditions, including those created by man (Tüxen 1956, Mueller-Dombois and Ellenberg 1974, Box and Fujiwara 2005). This definition makes it clear that PNV is not necessarily the original vegetation as the site conditions may have changed after the original vegetation was removed.

Trapnell and his co-workers (Trapnell *et al.* 1966, 1969, 1976, 1986; Trapnell and Brunt 1987) produced four sheets of a vegetation map for south-western Kenya at a scale of 1:250 000 that mapped vegetation as it was in 1960 (hereafter called the »original map«). We believe that the original map is still useful today as, despite the fact that the main aerial and field surveys were completed in the early 1960s, the map allowed to determine the PNV of the mapped area. Given that the distribution of species can be linked with the distribution of PNV, the new PNV map that we developed can assist in selecting species for particular locations within the map. Such selections can be linked conceptually to the ecological definition of agroforestry in 'mimicking natural ecosystems', which we interpret here to the detail of establishing similar tree species assemblages as those that were occurring under natural conditions.

Although Trapnell and his co-workers produced a detailed map, the documentation of the used methodology (i.e., Trapnell and Brunt 1987) in differentiating between different vegetation types lacks detail, especially since they did not provide the exact criteria that were used to differentiate between the various types. As we are convinced that the detail of the original vegetation maps was justified given the amount of survey work and the information provided within the limited documentation, the main attempt of this document is to provide lists of indigenous tree species for the different PNV types (hereafter called vegetation-specific species lists).

In accompanying documents (Kindt *et al.*, 2007, van Breugel *et al.*, 2007), we investigated published literature on differences between vegetation types and examined patterns of climatic, edaphic and topographic interpolated surface layers. These investigations revealed that floristic differences explain in part how the PNV types can be differentiated. Here we provide greater detail on how PNV types differ floristically.

As discussed below, there may not be a complete overlap between the distribution of a species and the distribution of vegetation types. This does not mean, however, that there is no congruence between vegetation and species lists as current views on the nature of community structure accept that any site possesses a reasonable predictable association of species that is

related to its environmental conditions. Neither does it mean that the many literature references that list typical species for specific types of vegetation should be disregarded.

In the appendix, we provide information on different uses that were listed for the species. This information can be used to select a number of species that can provide a particular service in a particular area within the map, although the caveat that the vegetation-species correspondence does not provide the complete information of where a species can occur should be expanded to a caveat that also the species-use correspondence documented in the appendix may not provide the total range of species for a particular use, or even list some species that are not most suitable to provide the particular use.

2. Methods

2.1 Compilation of species lists for potential natural vegetation types

It is unfortunate that the original vegetation maps and their documentation provide little information on the criteria that were used to distinguish between the different potential natural vegetation (PNV) types. Although the boundaries between the PNV types are provided on the map on a scale of 1:250 000, no information was provided on the actual criteria that were used to distinguish between the types on aerial photographs and during fieldwork.

We used five methods of inferences to obtain vegetation-specific species lists: (I_1) information from the legend of the map; (I_2) information from Trapnell (1997) on typical species for forest and bamboo vegetation types; (I_3) information from other sources of literature on vegetation types; (I_4) information from herbarium vouchers available from the East Africa Herbarium (based at the National Museums of Kenya); and (I_5) information from Beentje (1994) and species lists for particular forest surveys.

The first inference method was based on the species or genus names that were part of the names of some vegetation types in the original map (a complete list of all original vegetation types and how these correspond with the 17 PNV types of the new map is documented in Kindt *et al.* 2007). In many cases, the name of the original vegetation type only listed the generic name, but not the species name. In such cases, other inference methods often suggest what the species may be, although it is theoretically possible that the vegetation type of the legend refers to other species. Although there may be floristic or ecological reasons that a species may not be able to grow everywhere where a PNV type occurs (since the PNV types often cluster various vegetation classes and subclasses of the original map that do not occur everywhere in the map), we think that this information provides the best correspondence between the mapped vegetation and a species, as both species and vegetation distribution were available from the original maps.

The second method of inference was based on a reference by Trapnell (1997) that provided species lists for forest and bamboo PNV types. Since these species lists were compiled during the fieldwork of Trapnell and his co-workers when creating the original vegetation maps of which he was the principal author, we ranked the reliability of the correspondence of the species and the vegetation types in between that for the information from the legend (rank 1) and that of other sources of literature (rank 3). A difference of species of rank 1 with those of rank 2 could be that species of rank 1 are typical or dominant species for the listed vegetation types (as suggested by Beentje 1990).

Inference method 3 obtained species that were listed in other sources of literature than those of inference methods 1 and 2. Only species that were listed in Beentje (1994) as species that are occurring in Kenya were retained

in the lists. Beentje (1994) was also consulted for synonyms of botanical names. The fact that not a large number of species needed to be dropped from the vegetation-specific species lists confirms the interpretation by White (1983a) that vegetation boundaries can also delineate zones of plant endemism. Most species that needed to be dropped were secondary moist savanna species that were listed by White (1983a) within the Guineo-Congolian secondary grassland, as he mentioned that most of the species of the mosaic of Guineo-Congolian rainforest and secondary savanna species also occur in the Guineo-Congolian secondary grassland.

For inference method 4, we obtained information on herbarium positions from the East Africa Herbarium (based at the National Museums of Kenya). We think of this information as of lower reliability for correspondence between species and vegetation types than the previous inference methods for a number of reasons. The principal reasons to give lower priority to this list were that information was only obtained from a limited number of species (we initially selected the 124 species that were listed as indigenous to Kenya both in the *Agroforestry Database* [Simons *et al.* 2005] and in the *Useful trees and shrubs for Kenya* [Maundu and Tengnäs 2005]; but for only 110 species were herbarium positions obtained within the area covered by the map, see below) and that for many species only a small number of occurrence data was available (see table 1). The information from the herbarium vouchers is therefore likely to provide a biased picture of the distribution of typical species for the PNV types, whereas the previous references provide typical species for particular PNV types. Another reason that a biased picture may have occurred is that most herbarium positions were not the original coordinates of the location where the herbarium sample was collected, but were the coordinates of the nearest location that was listed in a gazetteer (a list of coordinates for names of locations). We did not exclude the herbarium records for which only gazetteer positions were available (as this would have reduced the number of positions very much, Table 1), but opted instead to only list species if the position (including gazetteer position) and the habitat description on the herbarium voucher agreed with the PNV type. We did not follow the rule for habitat description for some genera that formed part of the name of the vegetation type (*Acacia* and *Combretum*) and only relied on the positions. We did not follow the rule for positions for *Acacia* and allied vegetation on soils with impeded drainage given the scattered distribution of the vegetation type, and thus only relied on the habitat descriptions.

For 14 species that were listed in the *Agroforestry database* (Simons *et al.* 2005) and the *Useful trees and shrubs for Kenya* (Maundu and Tengnäs 2005), there were no herbarium positions that fell within the new map: *Acacia polyacantha* ssp. *campylacantha* (no specimens), *Azela quanzensis* (specimen positions only at the coast), *Albizia versicolor* (coast), *Borassus aethiopum* (no specimens), *Brachystegia spiciformis* (coast), *Commiphora myrrha* (north-east), *Elaeodendron schweinfurthianum* (coast), *Entada abyssinica* (no specimens), *Euphorbia tirucalli* (no specimens), *Moringa stenopetala* (north-west), *Rhizophora mucronata* (coast), *Ricinus communis* (no specimens), *Tamarix aphylla* (north-east), *Warburgia stuhlmannii* (coast) and *Xylopi aethiopica* (strange herbarium position at 40 m altitude).

Table 1. Herbarium records per species available at the East Africa Herbarium for a subset of species with native range in Kenya according to Simons et al. (2005) and Maundu and Tengnäs (2005). Species are sorted by total number of herbarium vouchers, which include vouchers outside the area covered by the map.

Species	Number of vouchers	Number of vouchers with original coordinates
<i>Rhus natalensis</i>	236	25
<i>Euclea divinorum</i>	161	19
<i>Cadaba farinosa</i>	142	11
<i>Combretum molle</i>	130	15
<i>Commiphora africana</i>	126	34
<i>Carissa edulis</i>	105	11
<i>Acacia senegal</i>	91	20
<i>Acacia mellifera</i>	89	19
<i>Cordia sinensis</i>	84	17
<i>Bridelia micrantha</i>	80	13
<i>Acacia seyal</i>	78	12
<i>Teclea nobilis</i>	77	8
<i>Terminalia brownii</i>	76	5
<i>Nuxia congesta</i>	75	10
<i>Ekebergia capensis</i>	75	9
<i>Ficus thonningii</i>	73	8
<i>Combretum aculeatum</i>	71	7
<i>Crotalaria goodiiiformis</i>	70	8
<i>Croton macrostachyus</i>	69	10
<i>Syzygium guineense</i>	66	10
<i>Grewia villosa</i>	65	8
<i>Syzygium cordatum</i>	59	4
<i>Ziziphus mucronata</i>	58	10
<i>Salvadora persica</i>	55	11
<i>Cassipourea malosana</i>	55	8
<i>Sesbania sesban</i>	55	4
<i>Albizia amara</i>	52	11
<i>Vangueria madagascariensis</i>	52	10
<i>Balanites aegyptiaca</i>	50	10
<i>Ximenia americana</i>	50	10
<i>Prunus africana</i>	50	8
<i>Acacia tortilis</i>	49	12
<i>Erythrina abyssinica</i>	48	6
<i>Boscia angustifolia</i>	48	5
<i>Senna singueana</i>	48	4
<i>Terminalia prunioides</i>	47	5
<i>Ficus sycomorus</i>	47	3
<i>Dichrostachys cinerea</i>	45	8
<i>Albizia anthelmintica</i>	44	7
<i>Flacourtia indica</i>	44	5
<i>Faurea saligna</i>	43	9
<i>Cordia africana</i>	43	5
<i>Juniperus procera</i>	42	8
<i>Cassia abbreviata</i>	42	5
<i>Trema orientalis</i>	41	10
<i>Zanthoxylum chalybeum</i>	41	7
<i>Podocarpus falcatus</i>	40	5
<i>Vangueria infausta</i>	40	5
<i>Grewia tenax</i>	39	6
<i>Trichilia emetica</i>	38	5
<i>Ziziphus abyssinica</i>	37	10
<i>Dodonaea viscosa</i>	37	4
<i>Ficus glumosa</i>	36	10
<i>Strychnos henningsii</i>	36	6
<i>Rauvolfia caffra</i>	36	4
<i>Albizia gummifera</i>	35	6
<i>Croton megalocarpus</i>	33	5

Species	Number of vouchers	Number of vouchers with original coordinates
<i>Acacia lahai</i>	33	4
<i>Grewia bicolor</i>	32	8
<i>Lawsonia inermis</i>	32	4
<i>Strychnos spinosa</i>	32	3
<i>Acacia xanthophloea</i>	31	3
<i>Calodendrum capense</i>	31	3
<i>Garcinia livingstonei</i>	30	7
<i>Berchemia discolor</i>	29	6
<i>Tamarindus indica</i>	29	4
<i>Macaranga kilimandscharica</i>	28	4
<i>Combretum collinum</i>	28	2
<i>Hagenia abyssinica</i>	28	2
<i>Harungana madagascariensis</i>	27	6
<i>Sapium ellipticum</i>	25	8
<i>Acacia elatior</i>	24	6
<i>Vitex doniana</i>	23	5
<i>Annona senegalensis</i>	22	4
<i>Vernonia amygdalina</i>	21	4
<i>Millettia dura</i>	21	0
<i>Dobera glabra</i>	20	5
<i>Kigelia africana</i>	20	4
<i>Sclerocarya birrea</i>	19	6
<i>Melia volkensii</i>	19	5
<i>Acacia nilotica</i>	19	3
<i>Delonix elata</i>	19	3
<i>Stereospermum kunthianum</i>	18	0
<i>Phoenix reclinata</i>	17	4
<i>Azanza garckeana</i>	17	0
<i>Markhamia lutea</i>	16	3
<i>Albizia coriaria</i>	16	1
<i>Dalbergia melanoxylon</i>	16	1
<i>Piliostigma thonningii</i>	16	1
<i>Vitex payos</i>	15	1
<i>Brachylaena huillensis</i>	15	0
<i>Ziziphus mauritiana</i>	14	5
<i>Ocotea usambarensis</i>	13	4
<i>Antiaris toxicaria</i>	13	2
<i>Newtonia buchananii</i>	13	2
<i>Polyscias kikuyuensis</i>	12	2
<i>Vitex keniensis</i>	12	0
<i>Diospyros mespiliformis</i>	11	4
<i>Spathodea campanulata</i>	9	2
<i>Parinari curatellifolia</i>	9	0
<i>Warburgia stuhlmannii</i>	7	6
<i>Acacia albida</i>	7	1
<i>Casimiroa edulis</i>	6	0
<i>Maesopsis eminii</i>	6	0
<i>Zanthoxylum gillettii</i>	6	0
<i>Adansonia digitata</i>	5	0
<i>Moringa stenopetala</i>	5	0
<i>Warburgia ugandensis</i>	4	3
<i>Olea capensis</i>	4	2
<i>Milicia excelsa</i>	4	0
<i>Olea europaea</i>	4	0
<i>Polyscias fulva</i>	3	2

For some species that were listed in the *Agroforestry Database* (Simons *et al.* 2005) and the *Useful trees and shrubs for Kenya* (Maundu and Tengnäs 2005), the rules followed for inference method 4 (position + habitat description) did not find any PNV types. For those species, we searched for information on habitat in Beentje (1994), species lists in Lind and Morrison (1974) and information on habitat from the herbarium vouchers. As mentioned above, we expect that such active search from species lists may not result in a typical list of species for a certain vegetation type, and we therefore attributed the lowest degree of correspondence (rank 5) to this inference between vegetation type and species.

Because of a progressively worse correspondence of these five types of information with the original vegetation types, we advise that users put higher trust in tables that are listed first. For this reason, species that are listed by an earlier inference method are not repeated in later tables, but information on their confirmation is mentioned. How various vegetation classification schemes correspond to each other is documented in the accompanying document (Kindt *et al.* 2007). Confirmation by herbarium positions means that the original or gazetteer position fell within the particular PNV type, but this was only possible for the subset of species for which herbarium voucher locations were available (see inference method 4 and Table 1). We used different references of Henk Beentje for confirmation analysis, as Beentje (1990) provides a more detailed classification of forest types than Beentje (1994), whereas Beentje (1990) only provides lists for forest types.

2.2 Details obtained from some literature references

Where specific literature references provided details additional to the link between a vegetation type and species occurrence, we attempted to include these details in the tables that document vegetation-specific species lists. For example, where a specific vegetation type was secondary to a PNV type, we provided information on the secondary nature of the vegetation type.

The information from Jolly *et al.* (1998) was interpreted as providing the following inferences about vegetation types: the tropical raingreen and savanna functional type (Tr3) corresponds to *Combretum* savanna, the evergreen (Te1 and Te2) and the wet-tropical raingreen trees types (Tr1) correspond to moist intermediate forest, dry-tropical raingreen trees (Tr2) corresponds to dry intermediate forest, the warm-temperate evergreen trees (wte) correspond to montane forests, the sclerophyll and xerophytic woods and scrubs types (Tss and tss) correspond to evergreen and semi-evergreen bushland and thickets, whereas the steppe (sf) corresponds to lowland *Acacia-Commiphora* bushland. Since these functional types do not overlap completely with the PNV types, the inference was only used in a confirmatory fashion.

For the references by Frank White, the abbreviations refer to whether the species was also listed as a species for Guineo-Congolian lowland rainforest (G), with closest relatives in Guineo-Congolian lowland rainforest (g), with closest

relatives elsewhere in the tropics but not in Guineo-Congolian rainforest (t), eastern montane (E), western montane (W) or island (I) populations, with information provided by White (1983b). The abbreviations were only added for those species that were listed in White (1983a), except for generalists that were listed as transgressors by White (1983b). White (1983b) used the Uluguru-Mulanje mountain system to characterize eastern African mountains, which occur further south than the Imatongs-Usambara system to which the Kenyan montane PNV types belong. Information from White (1978), however, shows that these two systems share most of the tree species that were investigated in the comparisons between the afromontane systems, with exceptions for *Brachylaena huillensis* and *Ptaeroxylon obliquum* that only occur in the Imatongs-Usambara system. The information provided between brackets as »Guineo-Congolian« refers to the description of various species as species of Guineo-Congolian lowland rainforest species that reach their easternmost limit in Kakamega forest mentioned in White (1983a).

2.3 Information on potential uses of indigenous tree species

We obtained information on potential uses of tree species for those species that were obtained by the different inference methods (see above). We consulted two sources of information on uses for tree species: (i) the *Agroforestry Tree Database* (Simons *et al.* 2005); and (ii) the *Useful trees and shrubs for Kenya* (ICRAF 1992, Maundu and Tengnäs 2005). From the first edition of the *Useful trees and shrubs for Kenya* (ICRAF 1992), and for the species that were listed there, we added information on the wood uses of flooring, boat building, and veneer or plywood. Tables with species and uses were compiled for each PNV type and were provided in Appendix I.

2.4 Ordination of potential natural vegetation types based on floristic differences

Community matrices were compiled for the 12 PNV types for which extensive species lists were obtained (excluding the alpine, montane moorland and scrubland, mixtures of broadleaved savanna and evergreen bushland, *Papyrus* and swamp, and grasslands on soils with impeded drainage PNV types), recording presence-absence of the 362 species that were encountered. Unconstrained (principal coordinates analysis) and constrained (distance-based redundancy analysis) ordination analyses were used to summarise relationships between the PNV types based on the Bray-Curtis and Kulczynski ecological distance measures (Legendre and Legendre 1998, Kindt and Coe 2005).

Bray-Curtis (A,C):

$$D = 1 - 2 \frac{\sum_{i=1}^S \min(a_i, c_i)}{\sum_{i=1}^S (a_i + c_i)}$$

$$\text{Kulczynski (A,C): } D = 1 - \frac{1}{2} \left(\frac{\sum_{i=1}^S \min(a_i, c_i)}{\sum_{i=1}^S a_i} + \frac{\sum_{i=1}^S \min(a_i, c_i)}{\sum_{i=1}^S c_i} \right)$$

(a_i : abundance of species i in community A ; b_i : abundance of species i in community B ; S : total number of species)

The constrained ordination analysis was based on the mean altitude and precipitation of each PNV type as calculated from sampled values from the interpolated surface layers (Kindt *et al.* 2007). Within the ordination diagrams, each PNV type was connected by an arrow with the type with which it had the smallest ecological distance (obviously excluding the same PNV type). The analyses were done for all species, only for species of inference 1-3 or only for species of inference 1-2 (see above). Analyses were done with the freely available Biodiversity.R statistical software (Kindt and Coe 2005).

3. Results

3.1 Species lists obtained from the various inference methods

Different methods were used to obtain the species lists of each PNV type. In total, 362 species were listed which ranged from 22 (bamboo, upland *Acacia*), over 24 (dry *Combretum* savanna), 28 (*Acacia* and allied vegetation on soils with impeded drainage), 29 (semi-evergreen thickets), 44 (moist *Combretum-Terminalia* savanna, evergreen and semi-evergreen bushland), 74 (dry intermediate forest), 91 (dry montane forest), 92 (lowland *Acacia-Commiphora*), 99 (moist montane forest) to 105 (moist intermediate forest). Species that were unique to particular PNV types followed a similar trend except for lowland *Acacia-Commiphora*, with 1 (upland *Acacia*) over 2 (bamboo, dry *Combretum* savanna), 5 (*Acacia* and allied vegetation on soils with impeded drainage), 8 (semi-evergreen thickets), 9 (evergreen and semi-evergreen bushland), 15 (dry montane forest), 18 (moist *Combretum-Terminalia* savanna), 20 (dry intermediate forest), 30 (moist intermediate forest), 35 (moist montane forest) to 61 (lowland *Acacia-Commiphora*) unique species. On average, species occurred on 1.9 PNV types, ranging from 1 (206 species) to 9 PNV types (*Rhus natalensis*). Other frequent species were *Carissa edulis* (8 PNV types), *Combretum molle* (7 PNV types) and *Acacia seyal* (6 PNV types)

Table 2 documents the species lists obtained from inference method 1, based on the legend of the original map. We provided some additional information that was available from the original map, such as whether the name was part of the class or subclass (boundaries are only drawn in the original map for the 55 classes and not for the 217 subclasses), or whether the original vegetation type was secondary or not.

Table 3 provides the species obtained by inference method 2 based on another reference of the main author of the original maps. Although we maintained a distinction between eastern and western distribution for some PNV types, we did not use the herbarium positions to confirm differentiation within the same PNV type (for example, we only tested whether the herbarium position was within moist intermediate forest, but not within the western part of the distribution of moist intermediate forest).

Table 2. Information on species composition provided in the legend of the original vegetation maps (Trapnell et al. 1966, 1969, 1976, 1986; Trapnell and Brunt 1987).

Vegetation type	Genus or species (original vegetation hierarchical level)	Confirmation ¹
Bamboo woodland and thicket	<i>Arundinaria alpina</i> (class)	TLB, White
	<i>Hagenia</i> (subclass)	Species in Table 2
Mountain scrubland and moorland	<i>Tree heathers</i> (subclass)	Species in TLB
Alpine	<i>Senecio</i> (class)	TLB
	<i>Lobelia</i> (class)	TLB
Moist montane forest	<i>Albizia</i> (subclass)	Species in Table 2
	<i>Aningeria</i> (subclass)	Species in Table 2
	<i>Catha edulis</i> (subclass, sometimes clearing)	Table 2
	<i>Clerodendrum</i> (clearing, subclass)	-
	<i>Cordia</i> (clearing, subclass)	Species in Table 4
	<i>Hagenia</i> (clearing, subclass)	Species in Table 2
	<i>Harungana</i> (clearing, subclass)	Species in Table 2
	<i>Macaranga</i> (subclass)	Species in Table 2
	<i>Myrica</i> (clearing, subclass)	Species in Table 2
	<i>Neoboutonia</i> (subclass)	Species in Table 2
	<i>Olea capensis</i>	Table 2
	<i>Podocarpus latifolius</i> (=milanjanus) (subclass)	Table 2
	<i>Polyscias</i> (subclass)	Species in Table 2
	<i>Prunus</i> (subclass, sometimes clearing)	Species in Table 2
	<i>Tabernaemontana</i> (=Conopharyngia) (secondary, subclass)	Species in Table 2
	<i>Triumfetta</i> (clearing, subclass)	-
Dry montane forest	<i>Acacia drepanolium</i> (secondary savanna or bushland, subclass)	-
	<i>Acacia gerrardii</i> (secondary savanna, subclass)	-
	<i>Acacia seyal</i> (secondary savanna, subclass)	Herbarium
	<i>Acokanthera</i> (clearing, class and subclass)	-
	<i>Cassipourea</i> (subclass)	Species in Table 2
	<i>Dodonaea</i> (secondary bushland, class or subclass)	Species in Table 2
	<i>Dombeya</i> (subclass, sometimes clearing)	Species in Table 2
	<i>Erythrina</i> (secondary savanna, class)	Species in TLB
	<i>Euphorbia</i> (subclass)	Species in Table 2
	<i>Juniperus procera</i> (class)	Table 2
	<i>Olinia</i> (secondary bushland, subclass)	Species in Beentje
	<i>Podocarpus falcatus</i> (=gracilior) (subclass)	Table 2
	<i>Podocarpus latifolius</i> (=milanjanus) (subclass)	Table 2
	<i>Prunus</i> (subclass)	Species in Table 2
	<i>Tarchonanthus</i> (secondary bushland, class)	Species in Table 2
	<i>Vernonia</i> (secondary savanna or scrub, class or subclass)	Species in Table 2
Moist intermediate forest	<i>Acacia</i> (secondary montane or clearing, subclass)	-
	<i>Acanthus</i> (clearing, subclass)	-
	<i>Albizia</i> (clearing, subclass)	Species in Table 2
	<i>Bridelia</i> (clearing, subclass)	Species in Table 2
	<i>Croton</i> (clearing, subclass)	Species in Table 2
	<i>Croton megalocarpus</i> (subclass)	Table 2
	<i>Cordia</i> (clearing, subclass)	Species in Table 2
	<i>Erythrina</i> (clearing or secondary savanna, class or subclass)	Species in TLB
	<i>Harungana</i> (clearing, subclass)	Species in Table 2
	<i>Lantana</i> (clearing, subclass)	-
	<i>Lovoa swynnertonii</i> (subclass)	Table 2
	<i>Macaranga</i> (clearing, subclass)	Species in White, Herbarium
	<i>Markhamia</i> (clearing, subclass)	Species in Table 2
	<i>Milicia</i> (=Chlorophora) (clearing, subclass)	Species in Table 2
	<i>Newtonia buchananii</i> (subclass)	Table 2
	<i>Ocotea</i> (subclass)	-
	<i>Premna</i> (subclass)	Species in Table 2
	<i>Vernonia</i> (clearing or secondary savanna, class or subclass)	Species in TLB and Table 4

Vegetation type	Genus or species (original vegetation hierarchical level)	Confirmation ¹
Dry intermediate forest	<i>Albizia</i> (clearing, subclass)	Species in Table 2
	<i>Brachylaena huillensis</i> (= <i>hutchinsii</i>) (subclass)	Table 2
	<i>Calodendron</i> (subclass)	Species in Table 2
	<i>Combretum</i> (secondary bushland, subclass)	Species in Table 4
	<i>Cordia</i> (clearing, subclass)	Species in Table 4
	<i>Croton</i> (clearing, subclass)	Species in Table 2
	<i>Croton macrostachyus</i> (clearing, subclass)	-
	<i>Croton megalocarpus</i> (subclass)	Table 2
	<i>Diospyros</i> (class)	Species in Table 2
	<i>Dodonaea</i> (secondary bushland, subclass)	Species in Table 4
	<i>Dombeya</i> (clearing, subclass)	TLB
	<i>Erythrina</i> (clearing or secondary savanna, class or subclass)	Species in TLB
	<i>Euclea</i> (clearing, subclass)	Species in Table 2
	<i>Lantana</i> (clearing, subclass)	-
	<i>Olea</i> (class)	Species in Table 2
	<i>Tarchonanthus</i> (secondary bushland, subclass)	-
	<i>Vernonia</i> (secondary bushland, subclass)	Species in TLB
Upland <i>Acacia</i> woodland, savanna and bushland	<i>Acacia brevispica</i> (subclass)	Beentje (woodland pp)
	<i>Acacia drepanolium</i> (subclass)	Beentje (savanna), LM (savanna)
	<i>Acacia etbaica</i> (subclass)	Beentje (savanna)
	<i>Acacia gerrardii</i> (subclass)	TLB, Beentje (savanna), LM (savanna)
	<i>Acacia kirkii</i> (class, subclass)	LM (woodland near rivers)
	<i>Acacia mellifera</i> (subclass)	Beentje (woodland pp), Herbarium
	<i>Acacia polyacantha</i> (subclass)	Beentje (savanna)
	<i>Acacia tortilis</i> (subclass)	Beentje (bushland pp), LM (savanna)
	<i>Acacia xanthophloea</i> (class)	LM (woodland near water), Herbarium
	<i>Albizia amara</i> ssp. <i>sericocephala</i>	
	<i>Combretum</i> (subclass)	Beentje (bushland pp), Herbarium
	<i>Tarchonanthus</i> (subgroup or class)	Species in Table 4
	<i>Terminalia</i> (subclass)	-
		-
Savanna – evergreen bushland mixtures	<i>Acacia</i> (subclass)	-
	<i>Combretum</i> (subclass)	-
	<i>Dodonaea</i> (subclass)	-
	<i>Dombeya</i> (subclass)	-
	<i>Heeria</i> (subclass)	-
	<i>Lannea</i> (subclass)	-
	<i>Terminalia</i> (subclass)	-
	<i>Uvaria</i> (subclass)	-
Lowland <i>Acacia-Commiphora</i> woodland, bushland and thicket		TLB, Beentje (bushland, woodland pp)
	<i>Acacia brevispica</i> (subclass)	TLB, White, Beentje (bushland pp)
	<i>Acacia reficiens</i> (subclass)	TLB, White, Beentje (bushland pp), Herbarium
	<i>Acacia tortilis</i> (class, subclass)	Species in White, Beentje, Jolly, Herbarium
	<i>Adansonia</i> (subclass)	Species in White, Beentje, Jolly, Herbarium
	<i>Combretum</i> (class)	Species in White, Beentje, Jolly, Herbarium
	<i>Commiphora</i> (group)	Species in White, Beentje, Herbarium
	<i>Terminalia</i> (subclass)	Species in White, Beentje

Vegetation type	Genus or species (original vegetation hierarchical level)	Confirmation ¹
Dry Combretum savanna	<i>Acacia</i> (subclass)	TLB, Herbarium
	<i>Combretum</i> (group)	Species in TLB, White, Jolly, Herbarium
	<i>Commiphora</i> (subclass)	Species in TLB, Jolly, Herbarium
	<i>Croton</i> (subclass)	-
	<i>Diospyros</i> (subclass)	-
	<i>Dodonaea</i> (subclass)	Species in Table 4
	<i>Faurea</i> (subgroup)	Species in Beentje and Herbarium
	<i>Faurea saligna</i> (subclass))	Beentje (savanna pp), Herbarium
	<i>Thespesia</i> (subclass)	-
	<i>Ozoroa</i> (=Heeria) (subclass)	-
	<i>Parinari</i> (subgroup or subclass)	-
	<i>Piliostigma</i> (subclass)	-
	<i>Terminalia</i> (subclass)	Species in TLB
Moist Combretum-Terminalia savanna	<i>Albizia</i> (subclass)	White
	<i>Bridelia</i> (subclass)	Species in Herbarium
	<i>Combretum</i> (group)	Species in TLB, White, Beentje, LM
	<i>Euclea racemosa</i> ssp. <i>schimperi</i> (subclass)	Beentje (savanna pp)
	<i>Erythrina</i> (subclass)	-
	<i>Faurea</i> (subgroup)	-
	<i>Faurea rochetiana</i> (=speciosa) (subclass)	Beentje (savanna pp)
	<i>Ficus</i> (subclass)	-
	<i>Ozoroa</i> (=Heeria) (subclass)	-
	<i>Parinari</i> (subgroup or subclass)	Species in White, Herbarium
	<i>Piliostigma</i> (subclass)	Species in White, Beentje, Herbarium
	<i>Terminalia</i> (group)	Species in TLB, White
	<i>Vernonia</i> (subclass)	-
Evergreen and semi-ever-green bushland	<i>Acacia brevispica</i> (secondary savanna, class or subclass)	-
	<i>Acacia drepanolobium</i> (class, sub-class, sometimes sec. types)	TLB, White (secondary)
	<i>Acacia gerrardii</i> (subclass, sometimes secondary savanna)	Species in TLB
	<i>Acacia hockii</i> (secondary savanna, subclass)	TLB, White (secondary)
	<i>Acacia mellifera</i> (secondary savanna, subclass)	Herbarium
	<i>Acacia seyal</i> (subclass, sometimes secondary savanna)	TLB, White (secondary), Herbarium
	<i>Albizia</i> (subclass)	-
	<i>Balanites</i> (subclass)	TLB
	<i>Combretum</i> (subclass)	Species in Table 4
	<i>Dodonaea</i> (subclass)	Species in White, Herbarium
	<i>Euphorbia</i> (subclass)	Species in White
	<i>Justicia</i> (secondary open grasslands, subclass)	-
	<i>Maerua</i> (subclass)	-
	<i>Olea</i> (subclass)	Species in TLB and White
	<i>Psiadia</i> (subclass)	-
	<i>Rhus</i> (subclass)	Species in TLB, White, Herbarium
	<i>Tarchonanthus</i> (class or subclass)	Species in TLB and White
	<i>Uvaria</i> (subclass)	-

Vegetation type	Genus or species (original vegetation hierarchical level)	Confirmation ¹
Semi-ever-green thickets	<i>Acacia brevispica</i> (subclass, sometimes secondary bushland)	TLB
	<i>Acacia seyal</i> (subclass, sometimes secondary bushland)	TLB, Herbarium
	<i>Albizia coriaria</i> (clearing and secondary bushland, subclass)	Herbarium
	<i>Balanites</i> (subclass, sometimes secondary bushland)	TLB
	<i>Combretum</i> (secondary savanna)	Species in Table 4
	<i>Euphorbia</i> (subclass, sometimes clearing)	TLB, species in White
	<i>Harrisonia</i> (subclass, sometimes secondary bushland)	Species in TLB
	<i>Lannea</i> (secondary savanna, subclass)	-
	<i>Lantana</i> (secondary scrub, subclass)	-
	<i>Ozoroa</i> (=Heeria) (secondary savanna, subclass)	-
	<i>Parinari</i> (secondary savanna, subclass)	-
	<i>Rhus</i> (clearing or secondary bushland, class or subclass)	Species in TLB, Herbarium
	<i>Terminalia</i> (secondary savanna, subclass)	-
Acacia and allied vegetation on soils with impeded drainage	<i>Turraea</i> (subclass, sometimes secondary bushland)	Species in TLB
	<i>Vitex</i> (secondary savanna, subclass)	-
	<i>Acacia gerrardii</i> (subclass)	LM
	<i>Acacia mellifera</i> (subclass)	White, LM (drier), Herbarium
	<i>Acacia polyacantha</i> (subclass)	TLB, Beentje, LM
	<i>Acacia seyal</i> (subclass)	TLB, White, Beentje, LM, Herbarium
	<i>Acacia sieberiana</i> (subclass)	-
	<i>Combretum</i> (subclass)	-
	<i>Euphorbia</i> (subclass)	Species in White
	<i>Lannea</i> (subclass)	-
	<i>Themeda</i> (class)	-

¹ Beentje: for forest types – Beentje (1990), for other vegetation types – Beentje (1994); Herbarium: information from position of the vouchers of the East Africa Herbarium; Jolly: Jolly *et al.* 1998, see main text for abbreviations; LM: Lind and Morrison (1974); TLB: Trapnell and Langdale Brown (1972); White: White (1983a).

Table 3. Species listed by Trapnell (1997) for the various forest and bamboo vegetation types.

Vegetation type	Region	Species	Confirmation ¹
General	All	<i>Albizia gummifera</i> (secondary)	TLB, Beentje, White[EWGI], Herbarium
		<i>Bersama abyssinica</i>	White[EWG]
		<i>Cassipourea malosana</i>	TLB, Beentje, LM, Herbarium
		<i>Croton macrostachyus</i> (secondary)	TLB, White[EWG], LM, Herbarium
		<i>Diospyros abyssinica</i>	TLB, Beentje, White (EWGI), LM
		<i>Dracaena steudneri</i>	-
		<i>Ehretia cymosa</i>	White [EWG]
		<i>Ekebergia capensis</i> (secondary)	Beentje, White [EWG], LM, Herbarium
		<i>Ficus sur</i>	-
		<i>Ficus thonningii</i>	LM, Herbarium
		<i>Nuxia congesta</i>	TLB, Beentje, White (EWI), LM, Herbarium
		<i>Teclea</i> (=Vepris) <i>nobilis</i>	Beentje, Herbarium
Bamboo	All	<i>Afrocrania</i> (=Cornus) <i>volkensii</i>	TLB, White, Beentje, LM
		<i>Euphorbia obovalifolia</i> (or marginal forest)	-
		<i>Galiniera saxifrage</i> (or marginal forest)	-
		<i>Gnidia glauca</i> (or marginal forest)	-
		<i>Hagenia abyssinica</i>	TLB, White, Beentje, LM, Herbarium
		<i>Hypericum revolutum</i> (or marginal forest)	-
		<i>Lepidotrichilia volkensii</i> (or marginal forest)	TLB, White, LM
		<i>Pittosporum lanatum</i> (or marginal forest)	-
		<i>Schefflera volkensii</i>	LM

Vegetation type	Region	Species	Confirmation ¹
Moist montane forest	All	<i>Acacia abyssinica</i> (invader)	
		<i>Afrocrania</i> (=Cornus) <i>volkensii</i> (marginal or bamboo)	TLB (woodland)
		<i>Alangium chinense</i> (secondary)	-
		<i>Albizia gummifera</i> (secondary in marginal forest)	Beentje, White (EWI), LM
		<i>Allophylus abyssinicus</i>	Beentje
		<i>Allophylus africanus</i> (residual)	LM
		<i>Aningeria</i> (=Pouteria) <i>adolphi-friederici</i> (climax)	-
		<i>Anthocleista grandiflora</i>	TLB, Beentje, White (Eg)
		<i>Apodytes dimidiata</i>	LM
		<i>Casaeria battiscombei</i> (also residual)	White (EWI), Jolly (wte)
		<i>Catha edulis</i> (secondary)	LM
		<i>Celtis africana</i>	-
		<i>Croton sylvaticus</i>	-
		<i>Dombeya torrida</i>	-
		<i>Dracaena afromontana</i>	-
		<i>Euphorbia obovalifolia</i> (marginal or bamboo)	-
		<i>Ficus lutea</i>	-
		<i>Galiniera saxifraga</i>	-
		<i>Hagenia abyssinica</i> (marginal or bamboo)	White (disturb., E), Jolly (wte), Herbarium
		<i>Harungana madagascariensis</i> (secondary)	Herbarium
		<i>Heinsenia diervillioides</i>	-
		<i>Kigelia moosa</i>	-
		<i>Lepidotrichilia volkensii</i> (marginal or bamboo)	-
		<i>Macaranga kilimandscharica</i> (secondary)	TLB, Herbarium
		<i>Maesa lanceolata</i>	-
		<i>Myrica salicifolia</i> (secondary)	White (EW), LM
		<i>Neoboutonia macrocalyx</i> (secondary)	Beentje, LM
		<i>Ocotea kenyensis</i> (climax)	TLB, Beentje, LM
		<i>Olea capensis</i> (=welwitschii)	TLB, White (EWG), Jolly (wte), LM, H.
		<i>Olea europaea ssp. africana</i> (residual)	Jolly (wte)
		<i>Oxyanthus speciosus</i>	-
		<i>Podocarpus latifolius</i> (=milanjianus) (climax)	TLB, White (EW), LM
		<i>Polyscias kikuyuensis</i> (secondary in marginal forest)	Beentje (endemic), Herbarium
		<i>Prunus africana</i> (also residual)	TLB, White (EWI), Jo (wte), LM, Herbarium
		<i>Psychotria mahonii</i>	-
		<i>Psydrax parviflora</i>	-
		<i>Rapanea melanophloeos</i>	Jolly (wte)
		<i>Schefflera abyssinica</i>	Beentje
		<i>Schefflera volkensii</i>	-
		<i>Strombosia scheffleri</i>	Beentje, White (EW), LM
		<i>Syzygium guineense</i>	Beentje, White (EWGI), LM, Herbarium
		<i>Tabernaemontana pachysiphon</i> (=holstii) (secondary)	LM (genus)
		<i>Tabernaemontana stapfiana</i> (=johnstonii) (secondary)	Beentje, White, LM (genus)
		<i>Turraea holstii</i>	-
		<i>Xymalos monospora</i>	White (EW)
		<i>Zanthoxylum gillettii</i>	Beentje, LM, Herbarium
		<i>Zanthoxylum rubescens</i>	-
	East only	<i>Cassipourea gummiflua</i>	White (EWI)
		<i>Chrysophyllum gorungosanum</i>	Beentje, White (Eg)
		<i>Cola greenwayi</i>	White (Eg)
		<i>Cylicopmorpha parviflora</i>	White
		<i>Garcinia volkensii</i>	-
		<i>Macaranga capensis</i>	-
		<i>Maytenus acuminata</i>	-
		<i>Ochna keniensis</i>	-
		<i>Ocotea usambarensis</i>	White (Et), LM, Herbarium
		<i>Synsepalum</i> (<i>Pachystela</i>) <i>brevipes</i>	-
		<i>Vitex keniensis</i>	Beentje (endemic), Herbarium

Vegetation type	Region	Species	Confirmation ¹
Dry montane forest	All	<i>Abutilon longicuspe</i> (secondary)	-
		<i>Acacia abyssinica</i> (invader)	TLB (woodland)
		<i>Acacia lahai</i> (invader)	TLB (woodland), HB
		<i>Afrocrania</i> (=Cornus) <i>volkensii</i> (marginal or bamboo)	Beentje
		<i>Apodytes dimidiata</i>	White (EWI)
		<i>Casaeria battiscombei</i>	-
		<i>Celtis africana</i>	LM
		<i>Cussonia holstii</i>	White (Et)
		<i>Cussonia spicata</i>	-
		<i>Dodonaea viscosa</i> (<i>angustifolia</i>) (secondary)	Herbarium
		<i>Dombeya burgessiae</i> (secondary)	-
		<i>Dombeya torrida</i> (=goetzenii) (secondary)	TLB, Beentje, LM
		<i>Dovyalis abyssinica</i>	-
		<i>Euclea divinorum</i> (secondary)	Herbarium
		<i>Euphorbia obovalifolia</i>	Beentje
		<i>Faurea saligna</i>	LM, Herbarium
		<i>Galiniera saxifrage</i> (marginal or bamboo)	-
		<i>Gnidia glauca</i> (marginal or bamboo)	Beentje
		<i>Hagenia abyssinica</i> (marginal or bamboo)	Beentje (disturb.), Jolly (wte), Herbarium
		<i>Hypericum revolutum</i> (marginal or bamboo)	LM
		<i>Ilex mitis</i>	White (EWI)
		<i>Juniperus procera</i> (<i>driest</i>)	White (E), Beentje, Jolly (wte), Herbarium
		<i>Lepidotrichilia volkensii</i> (marginal or bamboo)	-
		<i>Maytenus undata</i>	Beentje
		<i>Mystroxydon aethiopicum</i>	-
		<i>Ochna holstii</i>	-
		<i>Olea capensis</i> (=hochstetteri)	TLB, Beentje, Jolly (wte), LM
		<i>Olea europaea ssp africana</i> (secondary)	Beentje (occ. codo.), Jolly (wte), LM, H.
		<i>Olinia rochetiana</i> (=usambarensis)	TLB, Beentje, LM
		<i>Pistacia aethiopica</i>	-
		<i>Pittosporum lanatum</i> (marginal or bamboo)	-
		<i>Pittosporum viridiflorum</i>	-
		<i>Podocarpus falcatus</i> (=gracilior)	Beentje, White (EW), LM, Herbarium
		<i>Podocarpus latifolius</i> (=milanjianus) (moister)	Beentje, TLB, White (EW), LM
		<i>Prunus africana</i>	White (EWI), Jolly (wte), Herbarium
		<i>Rapanea melanophloeos</i>	Beentje, White (EWI), Jolly (wte)
		<i>Ritchiea albersii</i>	-
		<i>Schefflera abyssinica</i>	-
		<i>Schefflera volkensii</i> (marginal or bamboo)	-
		<i>Suregada procera</i>	-
		<i>Syzygium guineense</i> (also residual)	Beentje, Herbarium
		<i>Tarchonanthus camphoratus</i> (invader)	-
		<i>Trichocladus ellipticus</i>	-
		<i>Zanthoxylum usambarensis</i>	-

Vegetation type	Region	Species	Confirmation ¹
Moist intermediate forest	All	<i>Anthocleista grandiflora</i>	-
		<i>Blighia unijugata</i> (secondary)	-
		<i>Bridelia micrantha</i> (secondary)	Herbarium
		<i>Casaeria battiscombei</i>	LM (genus)
		<i>Celtis gomphophylla</i> (=durandii)	Beentje
		<i>Chaetacme aristata</i>	-
		<i>Cordia africana</i> (secondary)	Herbarium
		<i>Croton megalocarpus</i> (dominant in west)	TLB, Beentje, LM, Herbarium
		<i>Croton sylvaticus</i>	Beentje
		<i>Drypetes gerrardii</i>	LM (genus)
		<i>Fagaropsis angolensis</i>	-
		<i>Ficus exasperata</i>	-
		<i>Ficus lutea</i>	-
		<i>Harungana madagascariensis</i>	Jolly (Te1), Herbarium
		<i>Heinsenia diervillioides</i>	-
		<i>Kigelia moosa</i>	-
		<i>Manilkara butugi</i>	-
		<i>Markhamia lutea</i> (secondary)	-
		<i>Milicia excelsa</i>	Herbarium
		<i>Mimusops bagshawei</i>	-
		<i>Mimusops kummel</i>	-
		<i>Neoboutonia macrocalyx</i>	White (Eg)
		<i>Olea capensis</i>	Herbarium
		<i>Psydrax parviflora</i>	-
		<i>Rothmannia urcelliformis</i>	-
		<i>Sapium ellipticum</i>	Jolly (Tr1), Herbarium
		<i>Strombosia scheffleri</i>	Beentje, White (EW), LM (genus)
		<i>Tabernaemontana pachysiphon</i> (=holstii)	-
		<i>Tabernaemontana ventricosa</i>	-
		<i>Trema orientalis</i> (secondary)	Herbarium
		<i>Trichilia emetica</i>	Jolly (Te2), Herbarium
		<i>Turraea holstii</i>	White (Et)
		<i>Warburgia ugandensis</i>	-
		<i>Zanthoxylum gillettii</i> (=Fagara macrophylla)	LM, Herbarium
		<i>Zanthoxylum rubescens</i>	-
	West only	<i>Afroseralisia cerasifera</i>	-
		<i>Albizia zygia</i>	-
		<i>Allophylus ferrugineus</i>	-
		<i>Aningeria altissima</i>	White (Guineo-Congolian)
		<i>Anthocleista vogelii</i>	-
		<i>Antiaris toxicaria</i>	Herbarium
		<i>Cassipourea ruwensorensis</i>	-
		<i>Celtis mildbraedii</i>	-
		<i>Chrysophyllum albidum</i>	-
		<i>Cordia millenii</i>	White (Guineo-Congolian)
		<i>Entandophragma angolense</i>	White (Guineo-Congolian)
		<i>Ficus amadiensis</i>	-
		<i>Ficus saussureana</i>	-
		<i>Funtumia africana</i>	-
		<i>Garcinia buchananii</i>	-
		<i>Lecaniodiscus fraxinifolius</i>	White (Guineo-Congolian)
		<i>Maesopsis eminii</i> (secondary)	Herbarium
		<i>Manilkara butugi</i>	-
		<i>Monodera myristica</i>	White (Guineo-Congolian)
		<i>Polyscias fulva</i>	-
		<i>Premna angolensis</i>	-
		<i>Pseudospondias microcarpa</i>	-
		<i>Spathodea campanulata</i>	Herbarium
		<i>Trichilia dregeana</i>	-
		<i>Trilepisium madagascariense</i>	Jolly (Te2)
		<i>Zanthoxylum mildbraedii</i>	-
	East only	<i>Lovoa swynnertonii</i>	Beentje
		<i>Myrianthus holstii</i> (secondary)	-
		<i>Newtonia buchananii</i> (dominant)	Beentje, Herbarium
		<i>Premna maxima</i>	Beentje
		<i>Rauvolfia caffra</i>	Herbarium

Vegetation type	Region	Species	Confirmation ¹
Dry intermediate forest	All	<i>Acokanthera schimperi</i> (=friesiorum) (secondary)	LM
		<i>Albizia schimperiana</i> (secondary)	-
		<i>Brachylaena huillensis</i> (climax)	Beentje, LM, Herbarium
		<i>Bridelia micrantha</i> (secondary)	Herbarium
		<i>Calodendrum capense</i> (secondary)	Beentje, Herbarium
		<i>Cassipourea rotundifolia</i>	-
		<i>Chrysophyllum viridifolium</i>	Beentje
		<i>Craibia brownii</i>	-
		<i>Croton megalocarpus</i> (frequent)	Beentje, LM, Herbarium
		<i>Drypetes gerrardii</i>	Beentje
		<i>Elaeodendron buchananii</i>	LM
		<i>Euclea divinorum</i> ssp. <i>keniensis</i> (secondary)	Beentje, Herbarium
		<i>Euphorbia cussonoides</i>	Beentje (near-endemic)
		<i>Fagaropsis angolensis</i>	-
		<i>Ficus thonningii</i>	-
		<i>Heywoodia lucens</i>	-
		<i>Manilkara discolor</i>	-
		<i>Margaritaria</i> (=Phyllanthus) <i>discoidea</i>	LM
		<i>Markhamia lutea</i>	Herbarium
		<i>Mimusops bagshawei</i>	-
		<i>Mimusops kummel</i>	-
		<i>Olea europaea</i> ssp. <i>africana</i> (secondary)	Jolly (Tr2)
		<i>Psydrax</i> (=Canthium) <i>schimperiana</i>	LM
		<i>Rawsonia lucida</i>	-
		<i>Rothmannii urcelliformis</i>	-
		<i>Sapium ellipticum</i>	-
		<i>Schrebera alata</i>	LM
		<i>Strychnos henningsii</i>	TLB, Beentje, LM, Herbarium
		<i>Strychnos mitis</i>	Beentje
		<i>Teclea</i> (=Vepris) <i>simplicifolia</i>	Beentje, LM
		<i>Teclea trichocarpa</i>	-
		<i>Trema orientalis</i> (secondary)	Herbarium
		<i>Uvariadendron anisatum</i>	Beentje (near-endemic)
		<i>Warburgia ugandensis</i>	Herbarium

¹ Beentje: Beentje (1990); Herbarium: information from the position of the vouchers of the East Africa Herbarium; Jolly: Jolly et al. 1998, see main text for abbreviations; LM: Lind and Morrison (1974); TLB: Trapnell and Langdale Brown (1972); White: White (1983a), see main text for abbreviations; occ. dom.: occasionally dominant.

Table 4. Species lists provided by other sources of literature than the original vegetation map (Trapnell et al. 1966, 1969, 1976, 1986; Trapnell and Brunt 1987) and Trapnell (1997)

Vegetation type	Genus or species	Sources ¹
Bamboo woodland and thicket	<i>Dombeya torrida</i> (=goetzenii)	TLB (bamboo), White (bamboo), LM (Hagenia woodland)
	<i>Faurea saligna</i>	White (bamboo), LM (bamboo, Hagenia woodland), Herbarium
	<i>Ilex mitis</i>	White (bamboo)
	<i>Juniperus procera</i>	White (bamboo)
	<i>Myrica salicifolia</i>	TLB (bamboo)
	<i>Nuxia congesta</i>	White (bamboo), Herbarium (bamboo)
	<i>Podocarpus falcatus</i>	LM (bamboo)
	<i>Podocarpus latifolius</i> (=milanjianus)	TLB (bamboo), Beentje, White (bamboo), LM (bamboo)
	<i>Prunus africana</i>	White (bamboo), LM (Hagenia woodland), Herbarium (highland forest)
	<i>Rapanea melanophloeos</i> (=pulchra, =rhododendroides)	TLB (bamboo), White (bamboo), LM (Hagenia woodland)
	<i>Tabernaemontana johnstonii</i>	White (bamboo)
	<i>Xymalos monospora</i>	LM (bamboo)
Mountain scrubland and moorland Alpine	<i>Erica arborea</i>	TLB, Beentje
	<i>Stoebe kilimandscharica</i>	TLB, LM
	<i>Senecio</i>	TLB, LM
	<i>Lobelia</i>	TLB, LM
Moist montane forest	<i>Albizia grandibracteata</i>	LM (Aningeria forest)
	<i>Albizia zygia</i>	LM (Aningeria forest)
	<i>Canthium oligocarpum</i>	Beentje (endemic to Ocotea forest)
	<i>Chassalia kenyensis</i>	Beentje (endemic to Ocotea forest)
	<i>Coffea fadenii</i>	Beentje (endemic to Ocotea forest)
	<i>Craibia zimmermannii</i>	Beentje (endemic to Ocotea forest)
	<i>Drypetes gerrardii</i>	Beentje (codominant in Aningeria-Strombosia-Drypetes forest), White (Et)
	<i>Embelia keniensis</i>	Beentje (endemic to Albizia-Neoboutonia-Polyscias forest)
	<i>Entandophragma excelsum</i>	TLB, White (Eg)
	<i>Erythrina abyssinica</i>	TLB (secondary savanna)
	<i>Ilex mitis</i>	LM (Ocotea-Podocarpus, lower valleys)
	<i>Ixora scheffleri</i> ssp. <i>keniensis</i>	Beentje (endemic to Ocotea forest)
	<i>Maytenus keniensis</i>	Beentje (endemic to Ocotea forest)
	<i>Memecylon teitense</i>	Beentje (endemic to Ocotea forest)
	<i>Millettia oblata</i> ssp. <i>teitensis</i>	Beentje (endemic to Ocotea forest)
	<i>Mitragyna rubrostipulata</i>	White (Eg)
	<i>Myrianthus holstii</i>	White (Eg)
	<i>Ochna holstii</i>	White (Et)
	<i>Ozoroa insignis</i> ssp. <i>reticulata</i>	TLB (secondary savanna)
	<i>Polyscias fulva</i>	Beentje (Albizia-Neoboutonia-Polyscias forest), Jolly (wte)
	<i>Psychotria crassipetala</i>	Beentje (endemic to Ocotea forest)
	<i>Psychotria petiti</i>	Beentje (endemic to Ocotea forest)
	<i>Rhus natalensis</i>	TLB (secondary savanna), Herbarium
	<i>Rubus keniensis</i>	Beentje (endemic to Ocotea forest)
Dry montane forest	<i>Allophylus abyssinicus</i>	LM (Juniperus forest)
	<i>Calodendrum capense</i>	White (E), Herbarium (evergreen forest with Olea and Warburgia)
	<i>Croton megalocarpus</i>	Beentje (lower altitudes in mixed Podocarpus latifolius forest), LM (Juniperus forest), Herbarium (margins, not very common)
	<i>Drypetes gerrardii</i>	White (Et)
	<i>Elaeodendron</i> (=Cassine) <i>buchananii</i>	White
	<i>Erythrina abyssinica</i>	TLB (secondary savanna)
	<i>Halleria lucida</i>	White (E)
	<i>Maytenus heterophylla</i>	Beentje (Juniperus and Juniperus-Olea forest)
	<i>Myrsine africana</i>	LM (Juniperus forest)
	<i>Neoboutonia macrocalyx</i>	Beentje (low altitudes in mixed Podocarpus latifolius forest)
	<i>Nuxia floribunda</i>	Beentje (higher altitudes in mixed Podocarpus latifolius forest), White (Et)
	<i>Ocotea keniensis</i> (=bullata)	White
	<i>Ozoroa insignis</i> ssp. <i>reticulata</i>	TLB (secondary savanna)
	<i>Premna maxima</i>	Beentje (near-endemic in mixed Podocarpus latifolius forest)
	<i>Rhus natalensis</i>	TLB (secondary savanna), Herbarium

Vegetation type	Genus or species	Sources ¹
Moist intermediate forest	<i>Rinorea convallarioides</i> ssp. <i>Marsabitensis</i>	Beentje (endemic in mixed <i>Podocarpus latifolius</i> forest)
	<i>Schrebera alata</i>	White (EL)
	<i>Strychnos mitis</i>	Beentje (<i>Podocarpus latifolius</i> forest)
	<i>Tabernaemontana stapfiana</i>	Beentje (lower altitudes in mixed <i>Podocarpus</i> forest)
	<i>Teclea</i> (=Vepris) <i>simplicifolia</i>	TLB, Beentje (lower altitudes in <i>Juniperus-Nuxia-Podocarpus</i> forests)
	<i>Teclea trichocarpa</i>	Beentje (lower altitudes in <i>Juniperus-Nuxia-Podocarpus</i> forest)
	<i>Vernonia auriculifera</i>	TLB (secondary savanna)
	<i>Warburgia ugandensis</i>	Beentje (<i>Podocarpus falcatus</i> forest, <i>Juniperus</i> and <i>Juniperus-Olea</i> forests), LM (<i>Juniperus</i> forest), Herbarium (drier upland forest)
	<i>Xymalus monospora</i>	White
	<i>Apodytes dimidiata</i>	White (EWI)
	<i>Bequartiodendron oblanceolatum</i>	Beentje (typical for tropical rain forest)
	<i>Erythrina abyssinica</i>	TLB (secondary savanna), Herbarium
	<i>Macaranga kilimandscharica</i>	White (afromontane, Eg), Herbarium (rain montane forest)
	<i>Nuxia floribunda</i>	Beentje (Newtonia forest)
	<i>Ozoroa insignis</i> ssp. <i>reticulata</i>	TLB (secondary savanna)
	<i>Prunus africana</i>	White (afromontane, EWI), Jolly (Te2), Herbarium (tropical rain forest)
	<i>Nuxia floribunda</i>	Beentje (endemic to Newtonia forest)
	<i>Rapanea melanophloeos</i>	Beentje (Newtonia forest)
	<i>Rhus natalensis</i>	TLB (secondary savanna), Herbarium
	<i>Tabernaemontana stapfiana</i>	Beentje (Newtonia forest)
	<i>Tiliacora keniensis</i>	Beentje (endemic to tropical rain forest)
	<i>Vernonia auriculifera</i>	TLB (secondary savanna)
	<i>Xymalos monospora</i>	Beentje (Newtonia forest)
Dry intermediate forest	<i>Adenia metriosiphon</i>	Beentje (endemic to <i>Croton-Brachylaena-Calodendrum</i> forest)
	<i>Apodytes dimidiata</i>	LM (<i>Brachylaena-Croton</i> forest)
	<i>Canthium guineense</i>	Beentje (endemic to <i>Croton-Brachylaena-Calodendrum</i> forest)
	<i>Dombeya burgessiae</i>	LM (<i>Brachylaena-Croton</i> forest)
	<i>Erythrina abyssinica</i>	TLB (secondary savanna), Herbarium
	<i>Erythrocca bongensis</i>	LM (<i>Brachylaena-Croton</i> forest)
	<i>Juniperus procera</i>	LM (<i>Brachylaena-Croton</i> forest), Herbarium (dry upland evergreen forest)
	<i>Lepisanthes senegalensis</i>	Beentje (<i>Diospyros abyssinica</i> – <i>Olea europaea</i> forest)
	<i>Ochna ovata</i>	LM (<i>Brachylaena-Croton</i> forest)
	<i>Olea capensis</i>	Beentje (<i>Diospyros abyssinica</i> – <i>Olea europaea</i> forest), LM (<i>Brachylaena-Croton</i> forest)
	<i>Ozoroa insignis</i> ssp. <i>reticulata</i>	TLB (secondary savanna)
	<i>Rhus natalensis</i>	TLB (secondary savanna), Herbarium
	<i>Teclea villosa</i>	LM (<i>Brachylaena-Croton</i> forest)
	<i>Vernonia auriculifera</i>	TLB (secondary savanna)
Upland Acacia-woodland, savanna and bushland Lowland Acacia-Commiphora woodland, bushland and thicket	<i>Acacia nilotica</i>	TLB (savanna), Beentje (savanna), Herbarium (dry thorn scrub)
	<i>Acacia Senegal</i>	TLB (savanna), Beentje (woodland pp)
	<i>Acacia seyal</i>	TLB (savanna), Beentje (woodland pp), Herbarium (rocky bushland)
	<i>Acacia bussei</i>	TLB (bushland), White (characteristic canopy), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Acacia brevispica</i>	TLB (bushland), Beentje (woodland pp)
	<i>Acacia mellifera</i>	TLB (bushland), White (characteristic canopy), Beentje (<i>Acacia-Commiphora</i> bushland), Herbarium (<i>Acacia-Commiphora</i>)
	<i>Acacia nilotica</i> ssp. <i>subalata</i>	TLB (bushland), White (characteristic canopy), Beentje (woodland pp), Herbarium
	<i>Acacia polyacantha</i> ssp. <i>campylacantha</i>	TLB (woodland)
	<i>Acacia Senegal</i>	TLB (bushland), Beentje (<i>Acacia-Commiphora</i> woodland or bushland), Herbarium (with <i>Commiphora</i>)
	<i>Acacia thomasii</i>	White (characteristic canopy), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Acacia tortilis</i> ssp. <i>spirocarpa</i>	TLB (woodland, bushland), White (above canopy, clear trunk), Beentje (bushland pp), LM (drier woodland)
	<i>Acacia xanthophloea</i>	TLB (woodland)
	<i>Acalypha fruticosa</i>	TLB (bushland), Beentje (bushland pp)
	<i>Adansonia digitata</i>	White (above canopy, clear trunk), Beentje (woodland pp), Herbarium (<i>Acacia-Commiphora</i> savanna)

Vegetation type	Genus or species	Sources ¹
	<i>Adenium obesum</i>	White (stem-succulent), Beentje (bushland pp)
	<i>Balanites aegyptiaca</i>	LM (frequent), Herbarium (<i>Acacia-Commiphora</i> thicket)
	<i>Balanites rotundifolia</i> (=or-bicularis)	White (evergreen canopy), Beentje (bushland pp)
	<i>Bauhinia taitensis</i>	White (smaller), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Boscia coriacea</i>	TLB (bushland), White (evergreen canopy, secondary), Beentje (bushland pp)
	<i>Boswellia neglecta</i> (=hildebrandtii)	White (characteristic canopy), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Bouyeria</i> (=Ehretia) <i>teitensis</i>	White (smaller, secondary), Beentje (bushland pp)
	<i>Bridelia taitensis</i>	White (smaller), Beentje (woodland pp)
	<i>Cadaba farinose</i>	White (characteristic canopy), Beentje (bushland pp), Herbarium
	<i>Cadaba heterotricha</i>	White (characteristic canopy), Beentje (bushland pp)
	<i>Caesalpinia trochae</i>	White (smaller), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Calypotrothea somalensis</i>	White (stem-succulent)
	<i>Calypotrothea taitensis</i>	White (stem-succulent), Beentje (<i>Commiphora</i> bushland)
	<i>Carphalea</i> (=Dirichletia) <i>glaucescens</i>	White (smaller), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Cassia abbreviate ssp. kassneri</i>	White (characteristic canopy), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Caucanthus albidus</i>	White (smaller), Beentje (bushland pp)
	<i>Cissus quadrangularis</i>	White (climber), Beentje (bushland pp)
	<i>Cissus rotundifolia</i>	White (climber), Beentje (bushland pp)
	<i>Combretum aculeatum</i>	White (smaller), Beentje (<i>Acacia-Commiphora</i> bushland), Herbarium (<i>Acacia-Commiphora</i> bushland)
	<i>Commiphora africana</i>	White (characteristic canopy), Beentje (<i>Acacia-Commiphora</i> bushland), Herbarium (<i>Acacia-Commiphora</i>)
	<i>Commiphora campestris</i>	White (characteristic canopy), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Commiphora edulis</i> (= boiviniana)	White (characteristic canopy), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Commiphora holtziana</i> (= erythrae)	White (characteristic canopy), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Commiphora mollis</i> (= riparia)	White (characteristic canopy), Beentje (<i>Acacia-Commiphora</i> woodland)
	<i>Commiphora schimperi</i> (=throtae)	White (characteristic canopy), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Cordia monoica</i> (=ovalis)	White (characteristic canopy)
	<i>Cordia sinensis</i> (=gharaf, =rothii)	White (characteristic canopy), Beentje (bushland pp), Herbarium
	<i>Croton dichogamus</i>	TLB (bushland), Beentje (bushland pp)
	<i>Delonix elata</i>	White (above canopy, clear trunk), Beentje (<i>Acacia-Commiphora</i> bushland), Herbarium (hot dry country)
	<i>Dobera glabra</i>	White (evergreen canopy), Beentje (<i>Acacia-Commiphora</i> bushland or woodland), Herbarium
	<i>Dobera loranthifolia</i>	White (evergreen canopy), Beentje (bushland pp)
	<i>Erythroclamys spectabilis</i>	White (smaller), Beentje (<i>Acacia-Commiphora</i> bushland or woodland)
	<i>Euphorbia nyikae</i>	White (restricted succulent)
	<i>Euphorbia robecchii</i>	White (above canopy, clear trunk), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Euphorbia quinquecostata</i>	White (restricted succulent), Beentje (bushland pp)
	<i>Euphorbia scheffleri</i>	White (characteristic canopy), Beentje (bushland pp)
	<i>Gerrardanthus lobatus</i>	White (climber), Beentje (bushland pp)
	<i>Givotia gosai</i>	White (characteristic canopy), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Grewia fallax</i>	White (smaller), Beentje (bushland pp)
	<i>Grewia similis</i>	LM (common)
	<i>Grewia tembensis</i>	TLB (bushland), White (smaller), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Grewia tenax</i>	White (smaller), Beentje (bushland pp), Herbarium (under dense <i>Acacia reficiens</i>)
	<i>Grewia villosa</i>	White (smaller), Beentje (<i>Acacia-Commiphora</i> bushland), Herbarium (<i>Acacia-Commiphora</i> woodland)
	<i>Hymenodictyon parvifolium</i>	White (characteristic canopy), Beentje (bushland pp)
	<i>Kedrostis gijef</i>	White (climber), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Lannea alata</i>	White (characteristic canopy), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Lannea triphylla</i>	White (characteristic canopy), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Lannea schweinfurthii</i> (=stuhlmannii)	LM (common)
	<i>Maerua decumbens</i> (=subcordata)	White (smaller)

Vegetation type	Genus or species	Sources ¹
Dry Combretum savanna	<i>Maerua denhardtiorum</i>	White (smaller)
	<i>Melia volkensii</i>	White (above canopy, clear trunk), Beentje (bushland pp), Herbarium (<i>Acacia-Commiphora</i> savanna or bushland)
	<i>Platycelyphium voense</i>	White (characteristic canopy, secondary), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Premna hildebrandtii</i>	White (characteristic canopy)
	<i>Premna resinosa</i>	White (smaller), Beentje (bushland pp)
	<i>Salvadora persica</i>	White (evergreen canopy), Beentje (bushland pp), Jolly (sf), Herbarium (<i>Combretum-Commiphora</i> dry bushland)
	<i>Sesamothamnus rivae</i>	White (characteristic canopy), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Sterculia africana</i>	White (characteristic canopy), Beentje (bushland pp)
	<i>Sterculia stenocarpa</i>	Beentje (bushland pp)
	<i>Terminalia orbicularis</i>	White (thickets, impeded drainage), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Terminalia parvula</i>	White (characteristic canopy), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Terminalia spinosa</i>	White (above canopy, clear trunk), Beentje (<i>Acacia-Commiphora</i> bushland)
	<i>Thunbergia guerkeana</i>	White (climber), Beentje (bushland pp)
	<i>Thylachium thomasii</i>	White (characteristic canopy)
	<i>Combretum collinum</i> (=bind- erianum)	TLB, White (<i>Combretum</i> savanna pp), Herbarium (<i>Combretum</i> wooded and bushed grassland)
	<i>Combretum molle</i>	TLB, Herbarium (<i>Combretum</i> savanna)
	<i>Combretum zeyheri</i>	TLB
	<i>Commiphora africana</i>	TLB, Jolly (Tr3), Herbarium (savanna)
	<i>Terminalia brownie</i>	TLB, Herbarium (<i>Combretum</i> woodland)
Moist Combretum-Terminalia savanna	<i>Aningeria altissima</i>	White (Lake Victoria)
	<i>Annona senegalensis</i>	White (secondary grassland), UT (wet lowland savanna)
	<i>Antiaris toxicaria</i>	White (Lake Victoria), Herbarium
	<i>Borassus aethiopum</i>	White (secondary grassland)
	<i>Chrysophyllum albidum</i>	White (Lake Victoria)
	<i>Combretum collinum</i> (=bind- erianum)	TLB, White (secondary grassland), Beentje (<i>Combretum</i> savanna pp), LM (most common <i>Combretum</i> species), Herbarium
	<i>Combretum molle</i>	TLB, LM (most common <i>Combretum</i> species), Herbarium (dominant in <i>Combretum</i> savanna, high rainfall savanna)
	<i>Combretum zeyheri</i>	TLB
	<i>Cussonia arborea</i>	White (secondary grassland), Beentje (<i>Combretum</i> savanna pp)
	<i>Dichrostachys cinerea</i>	White (secondary grassland), Beentje (<i>Combretum</i> savanna pp), Jolly (Tr3), Herbarium (riverine)
	<i>Entada abyssinica</i>	White (secondary grassland)
	<i>Entandophragma angolense</i>	White (Lake Victoria)
	<i>Gardenia ternifolia</i>	White (secondary grassland)
	<i>Hymenocardia acida</i>	White (secondary grassland)
	<i>Maesopsis eminii</i>	White (Lake Victoria), LM (plantations)
	<i>Maytenus senegalensis</i>	White (secondary grassland), Jolly (Tr3)
	<i>Milicia</i> (=Chlorophora) <i>excelsa</i>	White (Lake Victoria), LM (plantations), Herbarium (cultivated area)
	<i>Morus mesozygia</i>	White (Lake Victoria)
	<i>Nauclea latifolia</i>	White (secondary grassland)
	<i>Parinari curatellifolia</i>	White (secondary grassland), Herbarium (savanna)
	<i>Piliostigma thonningii</i>	White (secondary grassland), Beentje (<i>Combretum</i> savanna), Herbarium (<i>Combretum</i> savanna)
	<i>Psorospermum febrifugum</i>	White (secondary grassland)
	<i>Securidaca longipedunculata</i>	White (secondary grassland)
	<i>Stereospermum kunthianum</i>	White (secondary grassland), Herbarium
	<i>Strychnos madagascariensis</i>	White (secondary grassland)
	<i>Strychnos spinosa</i>	White (secondary grassland)
	<i>Syzygium guineense</i>	White (secondary grassland, EWGI), Herbarium (<i>Combretum-Terminalia</i>)
	<i>Terminalia mollis</i>	TLB, Beentje (<i>Combretum</i> savanna)
	<i>Vitex doniana</i>	White (secondary grassland), Herbarium (high rainfall savanna)
Evergreen and semi-evergreen bushland	<i>Acacia gerrardii</i>	TLB (main species, secondary savanna)
	<i>Acacia kirkii</i>	White (secondary)
	<i>Acokanthera schimperi</i>	TLB, White (canopy), Beentje (semi-evergreen bushland)
	<i>Aloe kedongensis</i>	White (succulent), Beentje (evergreen bushland)
	<i>Calodendrum capense</i>	White (stunted at higher altitude, E)
	<i>Canthium keniense</i>	White (large bush)
	<i>Capparis fascicularis</i>	White (climber), Jolly (Tss)

Vegetation type	Genus or species	Sources ¹
Semi-evergreen thickets	<i>Carissa edulis</i>	TLB, White (evergreen, also secondary), Herbarium (evergreen-clump grass-land; bushland with <i>Grewia</i>)
	<i>Croton dichogamus</i>	White (large bush)
	<i>Cussonia holstii</i>	White (stunted at higher altitude, Et), Beentje (evergreen bushland)
	<i>Dodonaea viscosa</i> (=angustifolia)	White (evergreen, large bush, also secondary), Beentje (evergreen bushland), Jolly (tss), Herbarium (bushland with <i>Tarchonanthus</i>)
	<i>Dombeya burgessiae</i>	White (large bush), Beentje (semi-evergreen bushland)
	<i>Dracaena ellenbeckiana</i>	White (rosette tree), Beentje (semi-evergreen bushland)
	<i>Drypetes gerrardii</i>	White (stunted at higher altitude, Et)
	<i>Elaeodendron</i> (=Cassine) <i>buchananii</i>	White (stunted at higher altitude)
	<i>Euclea divinorum</i>	TLB (ssp. <i>keniensis</i>), White (evergreen, canopy, also secondary), Beentje (evergreen and semi-evergreen bushland), Herbarium (semi-deciduous bushland, <i>Tarchonanthus</i>)
	<i>Euclea racemosa</i> ssp. <i>schimperi</i>	White (evergreen, also secondary), Beentje (semi-evergreen bushland)
	<i>Euphorbia candelabrum</i>	White (emergent succulent), LM (subtype of Tsavo and Amboseli bushland)
	<i>Euphorbia tirucalli</i>	LM (subtype of Tsavo and Amboseli bushland)
	<i>Gnidia subcordata</i>	White (canopy), Beentje (evergreen bushland)
	<i>Grewia similis</i>	White (large bush), Beentje (evergreen bushland)
	<i>Grewia tembensis</i>	White (large bush)
	<i>Juniperus procera</i>	White (stunted at higher altitude; . Maybe the evergreen bushland is the original habitat of the species and not the dry montane forest, E), Jolly (tss), Herbarium (bushland)
	<i>Maytenus heterophylla</i>	White (large bush)
	<i>Olea europaea</i> ssp. <i>africana</i>	TLB (short), White (canopy, ELI)
	<i>Psiadia punctulata</i> (=Arabica)	White (shrub), Beentje (evergreen bushland)
	<i>Pterolobium stellatum</i>	White (climber)
	<i>Rhus natalensis</i>	TLB, White (large bush), Beentje (evergreen and semi-evergreen bushland), Herbarium (Maerua-Tarchonanthus)
	<i>Schrebera alata</i>	White (stunted at higher altitudes, EL), Beentje (evergreen bushland)
	<i>Scutia myrtina</i>	TLB, White (climber), Beentje (evergreen bushland)
	<i>Tarchonanthus camphorates</i>	TLB (secondary), White (evergreen, canopy, especially secondary), Beentje (evergreen and semi-evergreen bushland)
	<i>Teclea</i> (=Vepris) <i>simplicifolia</i>	White (canopy), Beentje (evergreen bushland)
	<i>Turraea mombassana</i>	White (shrub), Beentje (semi-evergreen bushland)
	<i>Acacia gerrardii</i>	White (secondary savanna)
	<i>Acacia hockii</i>	White (secondary savanna), Beentje (semi-evergreen bushland)
	<i>Acacia kirkii</i> ssp. <i>mildbraedii</i>	White (secondary savanna)
	<i>Acacia Senegal</i>	White (secondary savanna), Herbarium
	<i>Allophylus africanus</i>	White
	<i>Azima tetracantha</i>	White
	<i>Capparis fascicularis</i>	White, Jolly (Tss)
	<i>Capparis tomentosa</i>	White
	<i>Carissa edulis</i>	White, Herbarium
	<i>Cissus quadrangularis</i>	White (bushy)
	<i>Cissus rotundifolia</i>	White (bushy)
	<i>Erythrococca bongensis</i>	White
	<i>Euclea racemosa</i> ssp. <i>schimperi</i>	TLB, Beentje (semi-evergreen bushland)
	<i>Euphorbia candelabrum</i>	White (secondary savanna)
	<i>Grewia bicolour</i>	White
	<i>Harrisonia abyssinica</i>	TLB
	<i>Maerua triphylla</i> (=hildbrandtii)	White, Beentje (evergreen bushland)
	<i>Olea europaea</i> ssp. <i>africana</i>	White (ELI)
	<i>Psyrax</i> (=Canthium) <i>schimperiana</i>	White, Beentje (evergreen bushland)
	<i>Rhus natalensis</i>	TLB, White, Beentje (evergreen and semi-evergreen bushland), Herbarium (frequent in dry thickets)
	<i>Tarenna graveolens</i>	White
	<i>Teclea</i> (=Vepris) <i>nobilis</i>	TLB (reduced), Herbarium
	<i>Turraea nilotica</i>	White

Vegetation type	Genus or species	Sources ¹
Acacia and allied vegetation on soils with impeded drainage	<i>Turraea robusta</i>	TLB (secondary savanna, Et)
	<i>Acacia drepanolium</i>	TLB, White, Beentje (vertisol), LM (rainfall above 760 mm)
	<i>Acacia etbaica</i>	White
	<i>Acacia tortilis</i>	TLB, White, HH (little surface drainage)
	<i>Albizia amara</i>	White
	<i>Albizia harveyi</i>	White
	<i>Balanites</i>	TLB, species in Table 4
	<i>Commiphora schimperi</i>	White
	<i>Dalbergia melanoxylon</i>	White, Beentje (vertisol)
	<i>Lannea humilis</i>	White
	<i>Sclerocarya birrea</i>	White

¹ Beentje: for forest types – Beentje (1990), for other vegetation types and only confirming other sources – Beentje (1994); Herbarium: information from the position on the vouchers of the East Africa Herbarium, used for confirmation of other sources only and with information on habitat where this corresponded to the vegetation type; LM: Lind and Morrison (1974); TLB: Trapnell and Langdale Brown (1972); White: White (1983).

Table 5 provides the results for the analyses of the herbarium vouchers positions for the 110 species with positions within the map (inference method 4), excluding species that were listed earlier.

Table 6 documents the results of inference method 5 for those species for which position and habitat description (inference method 4) had not provided any PNV type. *Ziziphus mauritiana* was the only species for which no vegetation type could be identified with inference method 5. This is a species that is possibly introduced (Beentje 1994).

Table 5. Species lists obtained from the positions and habitat description from the East Africa herbarium for a limited number of species native to Kenya

Vegetation type	Genus or species	Habitat description of some herbarium vouchers
Moist montane forest	<i>Bridelia micrantha</i>	Forest with <i>Prunus africana</i>
	<i>Carissa edulis</i>	Forest edge
	<i>Combretum collinum</i>	Derived grassland
	<i>Euclea divinorum</i>	Forest
	<i>Faurea saligna</i>	Forest
	<i>Sapium ellipticum</i>	Forest
Dry montane forest	<i>Bridelia micrantha</i>	Forest
	<i>Carissa edulis</i>	Forest
	<i>Flacourtia indica</i>	Forest relict
	<i>Macaranga kilimandscharica</i>	Forest
	<i>Spathodea campanulata</i>	Intermediate forest
	<i>Syzygium cordatum</i>	Riverine forest
	<i>Trema orientalis</i>	Forest
	<i>Vangueria infausta</i>	Forest margins
Moist intermediate forest	<i>Acacia lahai</i>	Forest edge
	<i>Carissa edulis</i>	Forest of small trees and small shrubs (<i>Bridelia</i>)
	<i>Combretum molle</i>	Forested area
	<i>Flacourtia indica</i>	Forest relict
	<i>Hagenia abyssinica</i>	Lower montane forest
	<i>Kigelia africana</i>	Forest
	<i>Podocarpus falcatus</i>	Forest
	<i>Sesbania sesban</i>	Grassland in forest or riverine
	<i>Syzygium cordatum</i>	Forest remnants
	<i>Syzygium guineense</i>	Forest
	<i>Vangueria infausta</i>	Thicket in forest
	<i>Vernonia amygdalina</i>	Forest
	<i>Vitex doniana</i>	Forest glades in Kakamega
	<i>Ziziphus abyssinica</i>	Forest

Vegetation type	Genus or species	Habitat description of some herbarium vouchers
Dry intermediate forest	<i>Carissa edulis</i>	Forest
	<i>Combretum molle</i>	Forest but more often savanna
	<i>Cordia africana</i>	Open or forest edge
	<i>Crotalaria goodiaeformis</i>	Understorey in forest
	<i>Dodonaea viscosa</i>	Forest
	<i>Kigelia africana</i>	Riverine forest
	<i>Newtonia buchananii</i>	Dry evergreen forest dominated by <i>Croton megalocarpus</i>
	<i>Podocarpus falcatus</i>	Riverine forest dominated by <i>Diospyros abyssinica</i> , <i>Olea capensis</i> and <i>O. europaea</i>
	<i>Rauvolfia caffra</i>	Riverine
	<i>Sesbania sesban</i>	Riverine forest relicts
	<i>Syzygium cordatum</i>	Forest edge
	<i>Vangueria infausta</i>	Forest
Upland Acacia woodland, savanna and bushland	<i>Boscia angustifolia</i>	Dry bushland
	<i>Combretum molle</i>	Bushland
	<i>Dichrostachys cinerea</i>	Acacia-Commiphora woodland
	<i>Euclea divinorum</i>	Acacia-Tarchonanthus mixtures
	<i>Garcinia livingstonei</i>	Rock outcrops with <i>Acacia brevispica</i> , <i>A. mellifera</i>
	<i>Juniperus procera</i>	Acacia drepanolobium - <i>Themeda triandra</i> – <i>Tarchonanthus</i>
	<i>Kigelia africana</i>	High-level Acacia zones
	<i>Rhus natalensis</i>	Acacia xanthophloea or drepanolobium
	<i>Salvadora persica</i>	Acacia woodland or bushland
Lowland Acacia-Commiphora woodland, bushland and thicket	<i>Vangueria madagascariensis</i>	Thicket savanna with <i>Acacia brevispica</i> , <i>A. mellifera</i> and <i>A. drepanolobium</i>
	<i>Acacia elatior</i>	Riverline
	<i>Albizia amara</i>	Acacia woodland, Acacia-Balanites bushland
	<i>Albizia anthelmintica</i>	Dry bushland, Acacia-Balanites bushland
	<i>Boscia angustifolia</i>	Acacia-Commiphora bushland
	<i>Dalbergia melanoxylon</i>	Dry thorn-bush area
	<i>Grewia bicolor</i>	Acacia-Combretum bushland
	<i>Kigelia africana</i>	Acacia-Commiphora bushland
	<i>Lawsonia inermis</i>	Acacia-Commiphora bushland
	<i>Rhus natalensis</i>	Acacia-Commiphora bushland
	<i>Senna singueana</i>	Acacia-Commiphora dry woodland or bushland
	<i>Terminalia prunioides</i>	Acacia-Commiphora woodland or bushland
	<i>Vangueria madagascariensis</i>	Acacia woodland
	<i>Ximenia americana (=caffra)</i>	Acacia-Commiphora bushland
	<i>Zanthoxylum chalybeum</i>	Combretum-Commiphora woodland
	<i>Ziziphus mucronata</i>	Acacia-Combretum
Dry Combretum savanna	<i>Acacia senegal</i>	Savanna
	<i>Acacia seyal</i>	Combretum molle wooded and bushed grassland
	<i>Azanza garckeana</i>	Combretum savanna
	<i>Boscia angustifolia</i>	Combretum bushed grassland
	<i>Cadaba farinosa</i>	Savanna
	<i>Carissa edulis</i>	Combretum woodland
	<i>Combretum aculeatum</i>	Commiphora-Boswellia woodland
	<i>Cordia africana</i>	Dominant in higher portion of moist parkland
	<i>Dichrostachys cinerea</i>	Combretum savanna
	<i>Ekebergia capensis</i>	Savanna
	<i>Erythrina abyssinica</i>	Dry savanna
	<i>Flacourtia indica</i>	Combretum-Themeda savanna
	<i>Senna singueana</i>	Combretum-Themeda savanna
	<i>Stereospermum kunthianum</i>	Savanna
	<i>Strychnos spinosa</i>	Orchard country
	<i>Vangueria madagascariensis</i>	Combretum savanna
	<i>Vitex payos</i>	Wooded and bushed grassland
	<i>Ziziphus abyssinica</i>	Savanna

Vegetation type	Genus or species	Habitat description of some herbarium vouchers
Moist Combretum-Terminalia savanna	<i>Acacia lahai</i>	High rainfall savanna
	<i>Bridelia micrantha</i>	In <i>Combretum</i>
	<i>Cadaba farinosa</i>	Savanna
	<i>Carissa edulis</i>	Dense woodland with <i>Combretum</i> and <i>Terminalia</i>
	<i>Cordia africana</i>	<i>Combretum</i> savanna
	<i>Dodonaea viscosa</i>	Wooded grassland, forest relict
	<i>Ficus glumosa</i>	<i>Ficus-Combretum</i> woodland
	<i>Ficus sycomorus</i>	Open savanna, riverine
	<i>Ficus thonningii</i>	Savanna
	<i>Rhus natalensis</i>	Woodland of mainly <i>Combretum</i> and <i>Terminalia</i>
	<i>Sapium ellipticum</i>	Relicts of rain forest as riverine forest
	<i>Senna singueana</i>	High rainfall savanna
	<i>Vitex doniana</i>	High rainfall savanna
	<i>Ziziphus abyssinica</i>	<i>Combretum</i> woodland
Evergreen and semi-evergreen bushland	<i>Acacia xanthophloea</i>	<i>Tarchonanthus</i> and <i>Euphorbia</i>
	<i>Azanza garckeana</i>	Bushland with <i>Olea</i>
	<i>Combretum molle</i>	Open bushland with <i>Jasminum</i> and <i>Allophylus</i>
	<i>Flacourtia indica</i>	Rhus bush clumps
	<i>Senna singueana</i>	Common in bushland with <i>Olea europaea</i>
Semi-evergreen thickets	<i>Vangueria madagascariensis</i>	Semi-deciduous bushland
	<i>Cordia sinensis</i>	Lake shore
Acacia and allied vegetation on soils with impeded drainage	<i>Grewia villosa</i>	Lake shore
	<i>Acacia elatior</i>	Little surface drainage
	<i>Acacia senegal</i>	Little surface drainage
	<i>Acacia xanthophloea</i>	Vertisol
	<i>Balanites aegyptiaca</i>	Little surface drainage, seasonally flooded
	<i>Cadaba farinosa</i>	Seasonal drainage impediment, black clay soil
	<i>Combretum molle</i>	Impeded drainage
	<i>Cordia sinensis</i>	Little surface drainage
	<i>Grewia tenax</i>	Little surface drainage
	<i>Phoenix reclinata</i>	Riverine with <i>Acacia xanthophloea</i>
	<i>Polyscias fulva</i>	Swamp forest with <i>Acacia xanthophloea</i>
	<i>Salvadora persica</i>	Poor surface drainage
	<i>Sesbania sesban</i>	Black cotton soil, lake shore
	<i>Syzygium guineense</i>	Badly drained areas
	<i>Ziziphus mucronata</i>	Poor drainage

Table 6. Information from species lists and habitat descriptions for species that were not listed in previous tables

Vegetation type	Genus or species	Some positions	Habitat ¹
Moist intermediate forest	<i>Millettia dura</i>	Yes	Beentje (moist forest edge) LM (colonising forest in the Lake Victoria belt)
	<i>Diospyros mespiliformis</i>	No	Beentje (riverine and dry forest)
Dry intermediate forest			LM (riverine forest in Tanzania below 2000 m)
	<i>Faidherbia albida</i>	No	Beentje (riverine)
Low Acacia woodland, bushland and thicket	<i>Berchemia discolor</i>	Yes	Herbarium (<i>Acacia-Commiphora</i> bushland)
	<i>Tamarindus indica</i>	No	Herbarium (Wooded grassland and bushland dominated by <i>Acacia nilotica</i> , <i>A. seyal</i> and <i>Commiphora africana</i>)

¹ Beentje: Beentje (1994); Herbarium: information from the position on the vouchers of the East Africa Herbarium, information on habitat where position did not corresponded to the vegetation type; LM: information from species lists from Lind and Morrison (1974)

3.2 Information on uses

Information was available from the two references (Simons *et al.* 2005, Maunda and Tengnas 2005) that we consulted for 203 species. These uses were tabulated in Appendix I for the 12 PNV types with large numbers of species.

The 203 species ranged from 13 (bamboo), over 22 (upland *Acacia*, semi-evergreen thickets), 23 (dry *Combretum* savanna), 25 (*Acacia* and allied vegetation on soils with impeded drainage), 33 (evergreen and semi-evergreen bushland), 36 (moist *Combretum-Terminalia* savanna), 53 (lowland *Acacia-Commiphora*), 54 (moist montane forest), 55 (dry intermediate forest), 60 (dry montane forest) to 72 (moist intermediate forest). What was clearly different to the list with all species was the lower position of lowland *Acacia-Commiphora* as it was now listed below all forest types. Species that were unique (endemic) to particular PNV types followed a different trend with 1 (bamboo, upland *Acacia*) over 2 (dry montane forest, dry *Combretum* savanna), 3 (evergreen and semi-evergreen bushland, semi-evergreen thickets, *Acacia* and allied vegetation on soils with impeded drainage), 7 (moist montane forest), 9 (dry intermediate forest), 13 (moist intermediate forest, moist *Combretum-Terminalia* savanna) to 27 (lowland *Acacia-Commiphora*) species. For unique species, forest PNV types were not always the types with highest numbers of species.

3.3 Description of potential natural vegetation types with information from spatial datasets

Although the unconstrained ordinations were only based on floristic differences, they separated PNV types of different physiognomic categories. Ordinations based on the Bray-Curtis (Figure 1a) and Kulczynski (Figure 1b) distances clearly differentiated forest types (DMF, MMF, DIF and MIF) and bamboo from the other PNV types. Bamboo is associated with dry montane forest, which is a result from the ecotone between the two types (Trapnell 1997). Within the other PNV types, the *Combretum* savanna types were clearly differentiated (Figure 1a, Figure 1b), which confirms the suspected floristic differences with savanna types identified by *Acacia* species. Evergreen bushland is most similar to upland *Acacia*, whereas semi-evergreen thicket is very similar to evergreen bushland. Both diagrams suggest that floristic differences among the three *Acacia* types are small relative to the other types.

The constrained ordination results show that a combination of floristic and environmental differences can explain the differences of the various types (Figure 1b, Figure 2b). The floristic difference of the forest and bamboo types to the other types can be explained by their higher altitude and rainfall, whereas differences within forest PNV types can be explained by the combination of altitude and precipitation (as suggested by the names of the PNV types). The difference between dry *Combretum* savanna and semi-evergreen thickets became less clear in the diagram as semi-evergreen thickets

have higher average rainfall than dry *Combretum* savanna. Within the driest conditions, a sequence from evergreen bushland over upland *Acacia* and *Acacia* and allied vegetation on impeded drainage to lowland *Acacia-Commiphora* savanna can be observed, indicating that there are clearer floristic differences between these types than indicated by the unconstrained ordination and that these are related to differences in altitude.

Analysis only with species of the first levels of inference revealed that relationships between PNV types became less clear, although similar trends could be observed (figures 1c-d, 2c-d). Where analyses with all species indicated a sequence of moist montane forest → dry montane forest → dry intermediate forest → moist intermediate forest, analyses with species of inference 1-3 (figures 1c, 2c) suggested the sequence moist intermediate forest → moist montane forest → dry montane forest → dry intermediate forest (thus giving priority to moisture over altitude). Analyses with species of inference 1-2 (figures 1d, 2d) grouped intermediate and montane forests in separate clusters. Where species of inference 1-3 clustered the two *Combretum* savannas separately (figures 1c, 1d), species of inference 1-2 suggested that Moist *Combretum-Terminalia* savanna is more similar to bamboo (the difference between all species and those of inference 1-3 was already that bamboo and moist *Combretum-Terminalia* were more similar with the smaller subset of species). In an analogous fashion, species of inference 1-3 clustered the evergreen bushland and semi-evergreen thickets separately (figures 1c, 1d), whereas species of inference 1-2 confused these two types with *Acacia* PNV types.

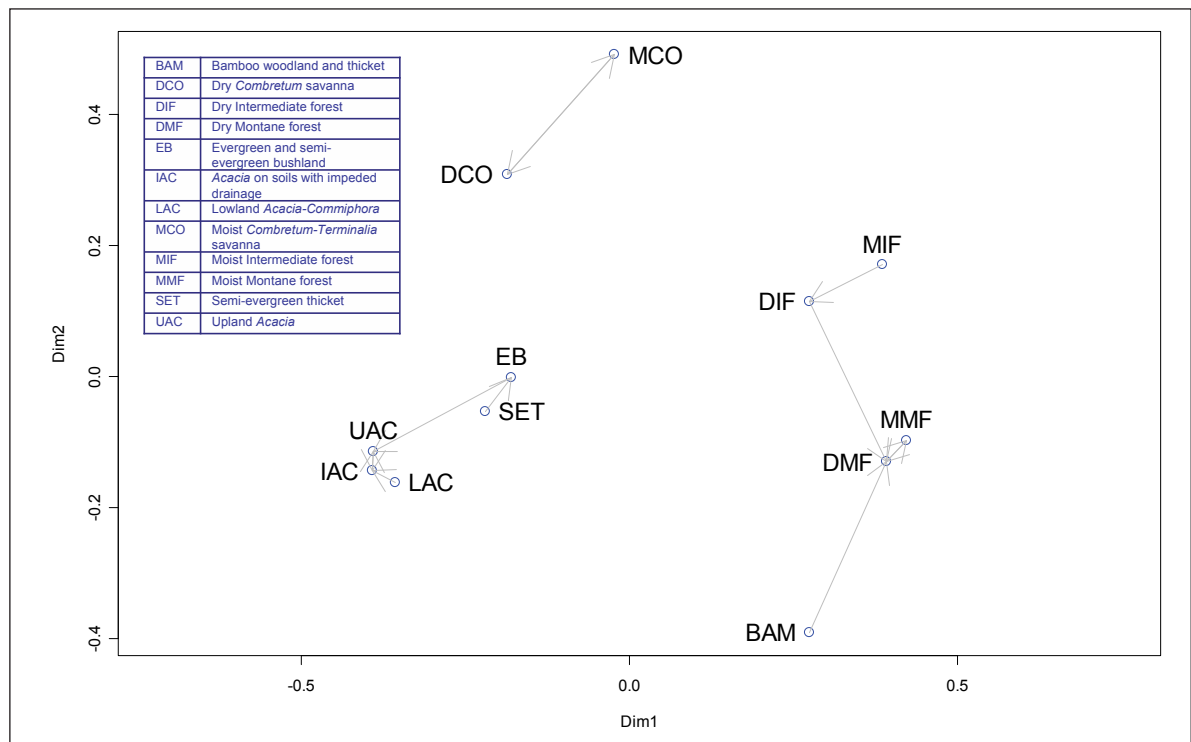


Fig 1a

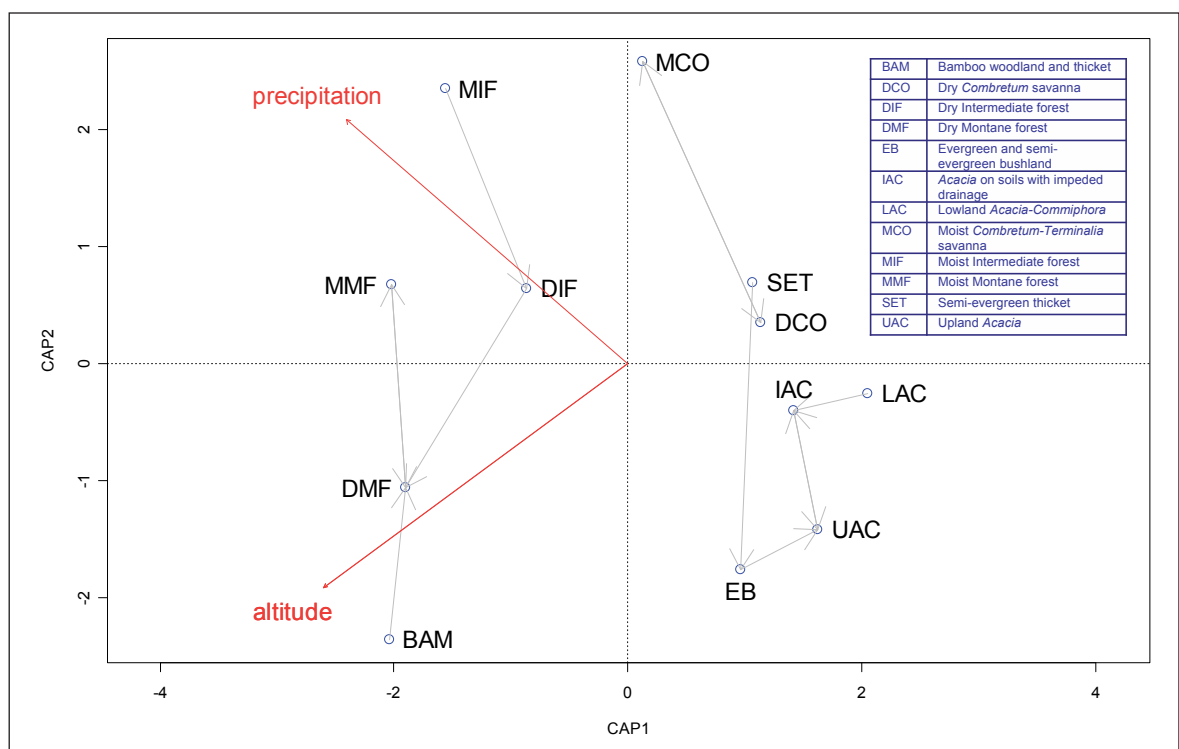


Fig 1b

Figure 1. Floristic relationships between potential natural vegetation types revealed by the Bray-Curtis distance and principal coordinates analysis (a, c, d) and distance-based redundancy analysis (b). Community datasets were based on presence-absence for all species (a, b), species of inferences 1-3 (c) or species of inferences 1-2 (d).

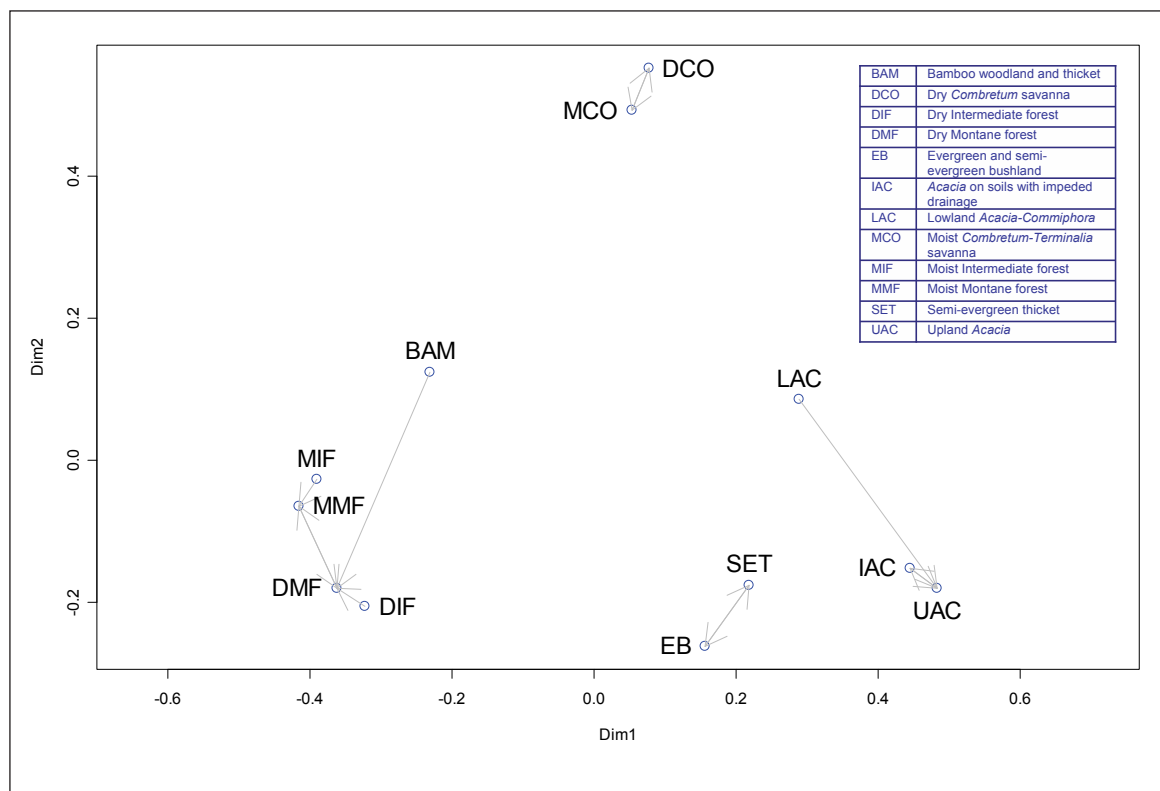


Fig 1c

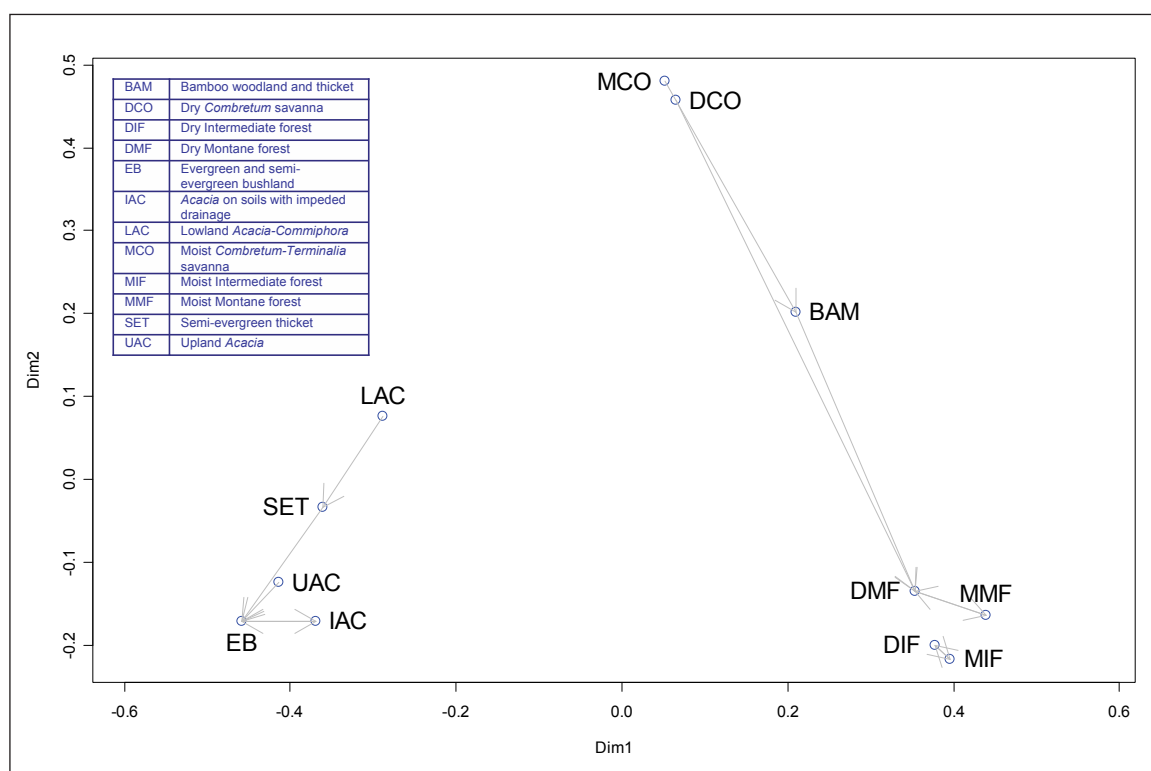


Fig 1d

Figure 1. cont.d

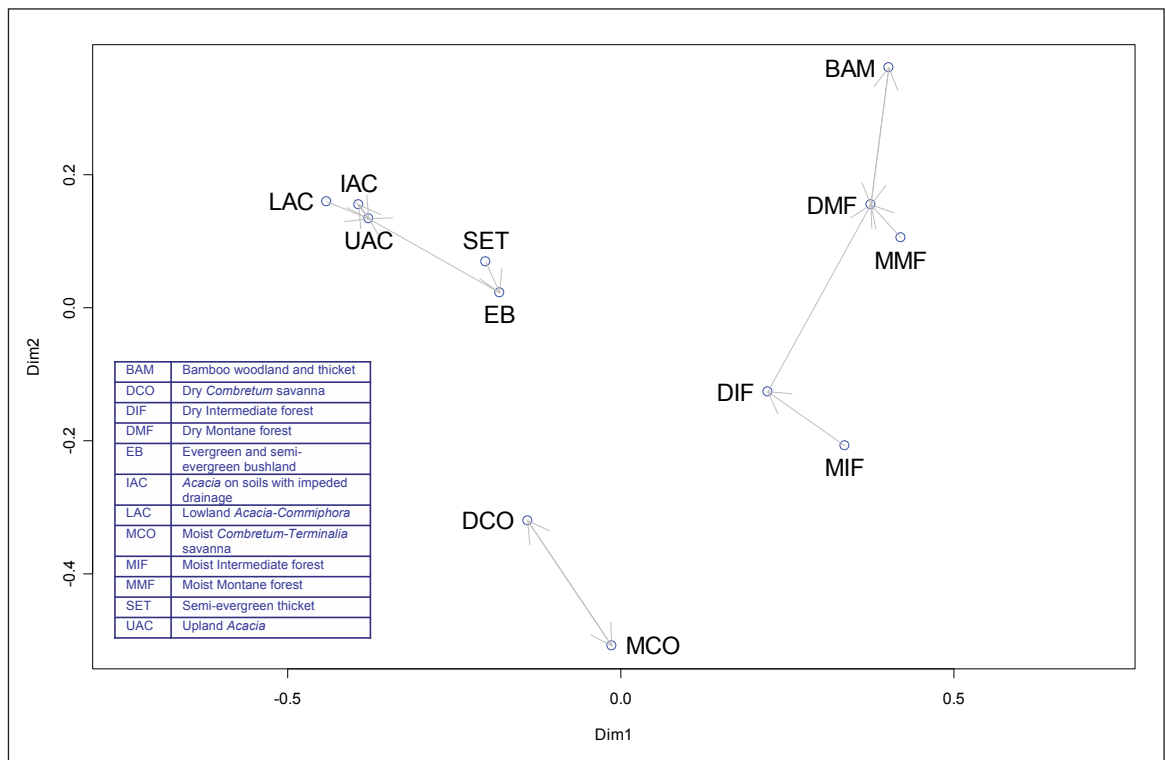


Fig 2a

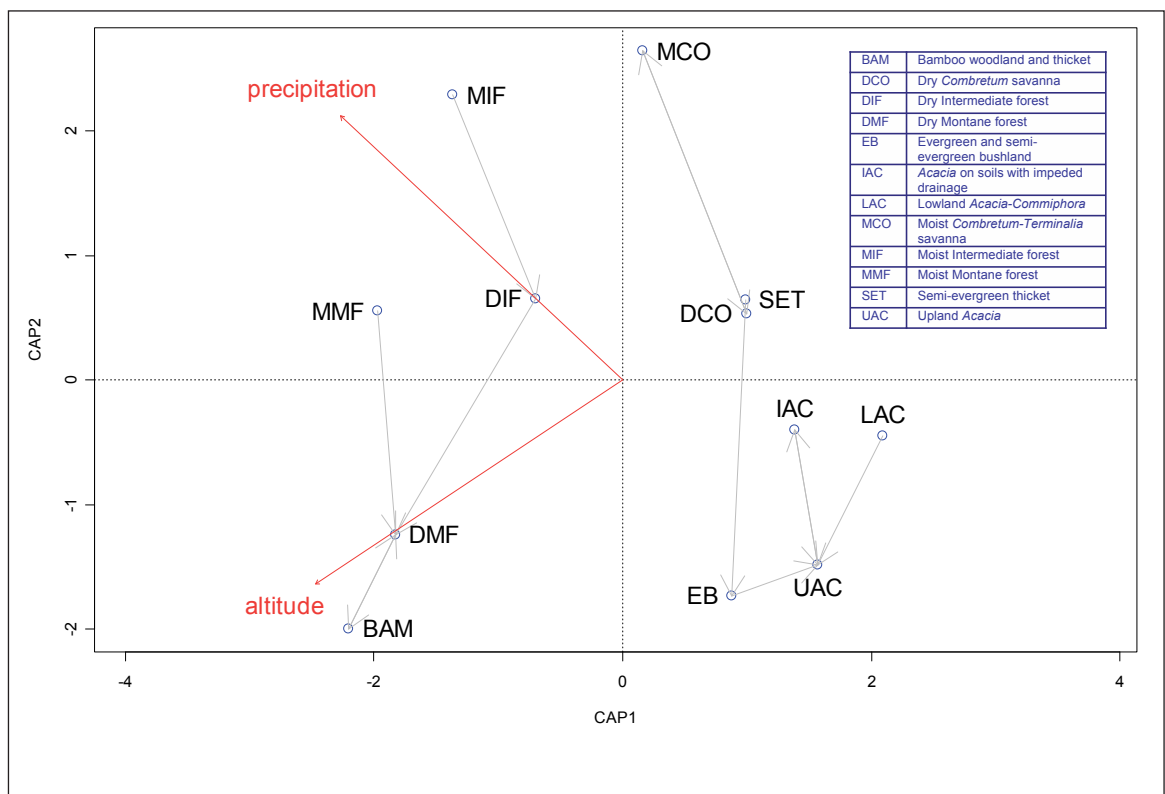


Fig 2b

Figure 2. Floristic relationships between potential natural vegetation types revealed by the Kulczynski distance and principal coordinates analysis (a, c, d) and distance-based redundancy analysis (b). Community datasets were based on presence-absence for all species (a, b), species of inferences 1-3 (c) or species of inferences 1-2 (d).

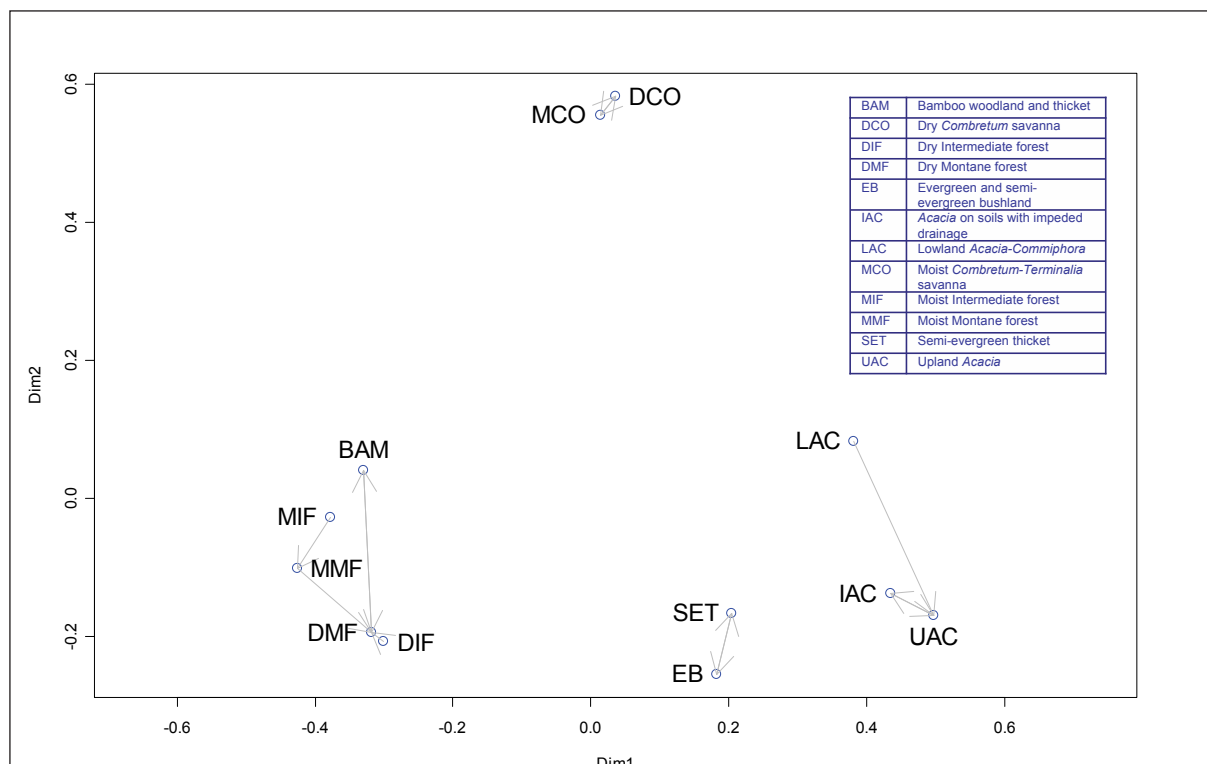


Fig 2c

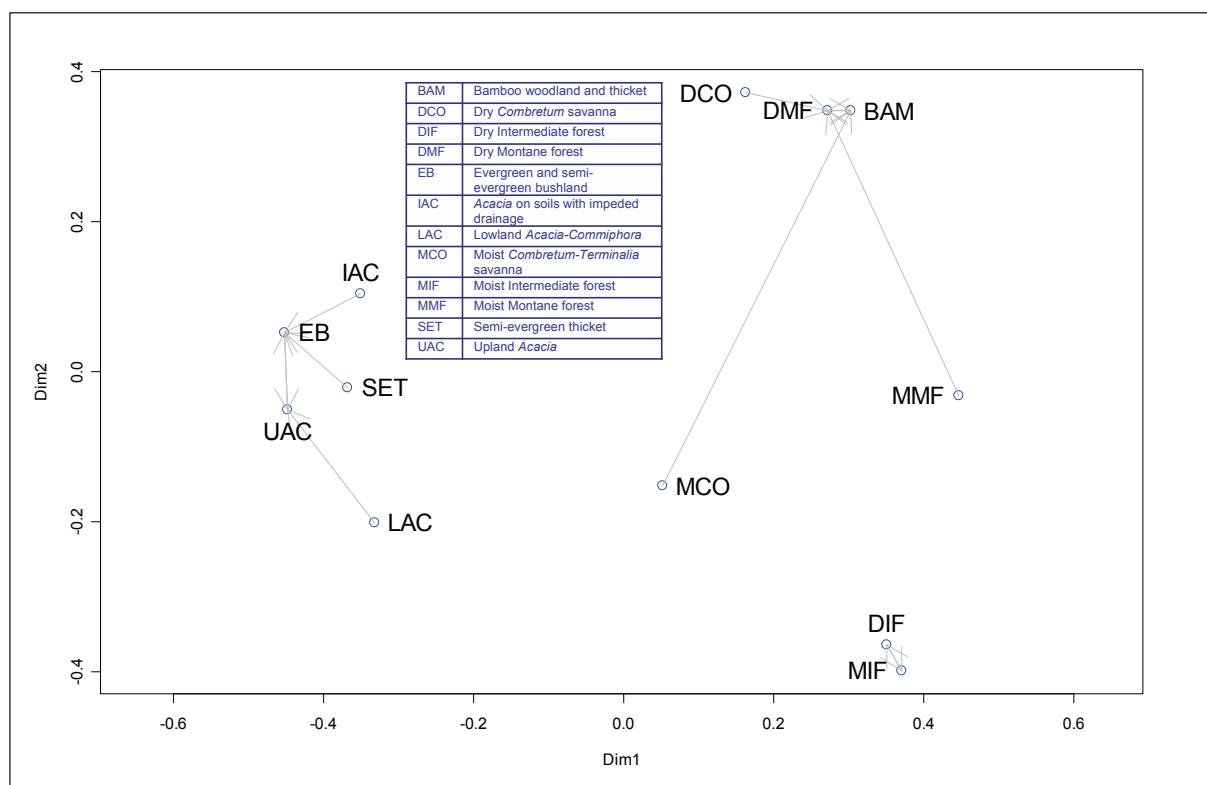


Fig 2d

Figure 2. continued

4. Discussion

4.1 Obtained floristic differentiation

The information from the literature and ordination analyses provided clear evidence for floristic differences between potential natural vegetation (PNV) types. Unique species were listed for each PNV type, whereas a large number of species was compiled (362 species in total, 203 species with information on potential uses). The PNV types that were richest in species (> 70 species) were the four forest and the lowland *Acacia-Commiphora* PNV types. Smallest numbers of species (between 20-25 species) were tabulated for the bamboo and dry *Combretum* savanna PNV types. Many species were mentioned in several references, confirming the correspondence between the types inferred by the names of the different vegetation classification schemes (Kindt *et al.* 2007).

The species lists are tentative for the vegetation types. It is possible that some species only occur within a limited area of the area occupied by a certain vegetation type, whereas it is also possible that species occur in a wider area than delimited by vegetation boundaries (especially if ecotones exist). Since the vegetation types do not always form contiguous areas, species may also not occur everywhere where the vegetation type occurs. For example, some species were only encountered in forests in the western part of the map and not the eastern part of the map (Trapnell 1997, Table 3). Given that many biotic factors also influence the distribution of species (see below), it may therefore not be possible for some of these species to grow in the eastern part of the map if vegetation types only provide information on the abiotic factors. Future studies may therefore update the species lists that are provided here, and more detailed studies could explore the correspondence between the boundaries of species suitability maps and the boundaries of the vegetation maps for species of particular interest, and various factors that contribute to ecosystem restoration should also be considered. The hypothesis that the boundaries of the vegetation map provide floristic differences can also be tested with ordination analysis (using similar methods as used in this document, but now allowing for significance testing), but with several samples for each vegetation type. Careful selection of sample units at increasing distance from boundaries could be used in particular to test hypotheses of the accuracy of boundaries and ecotones.

We also want to point out that the information on uses should be interpreted carefully. For example, *Euphorbia candelabrum* was mentioned for bee forage in the second edition of the *Useful trees and shrubs for Kenya* (Maundu and Tengnäs 2005), whereas the first edition mentioned that 'honey from flowers burn the mouth' (ICRAF 1992, p. 209). In this case we removed bee forage as potential use for this species in Appendix I, but we did not systematically check the correspondence between the various references and mainly relied on Maundu and Tengnäs (2005) as this reference provided information on a wider range of species. Users should also be aware of the statement by Maundu and Tengnäs (2005, pp. 5-6) on information on tree uses that:

»It is important to note that the uses listed are those that have been *re-reported or deemed to be worth reporting*. The use of trees and other plants in herbal medicine is a huge subject, and for several reasons this book does not provide details on local preparations and administrations of herbal medicines«

4.2 Species suitability maps

As information on occurrence of species is limited for the majority of species (Ferrier 2002a), distribution maps of vegetation often provide the best information that is available to date to map the distribution of the majority of species. Better models of distribution of species can only be constructed by expanding the information of where on earth a species occurs, and, if possible, including information on where a species can not occur. Some argue to exclude sink population locations from the data of where a species can occur to make better models of where a species can reproduce and survive (Guisan and Thuiller 2005). As some researchers may be wishing to build better models for species of particular interest, we first provide an overview of some of the recent methods that have been used to produce suitability maps for particular species.

Many statistical modelling approaches have been developed to model species distribution, including artificial neural networks (ANN), Bayesian modelling (BM), bioclimatic profiles (BP, implemented in BIOCLIM software), classification and regression trees (CART), discriminant analysis (DA), ecological niche factor analysis (ENFA, implemented in the BIOMAPPER software), generalised additive models (GAM), generalised dissimilarity modelling (GDM), generalised linear models (GLM), genetic algorithms (GA, implemented in the desktop-GARP software), gower-similarity (implemented in the DOMAIN software), Mahalanobis distance (MD), maximum entropy (ME) and spatial interpolation (SI) (Segurado and Araújo 2004; Guisan and Thuiller 2005). Thuiller (2003) describes the biodiversity modelling approach (BIOMOD) that selects the model that provides the best predictions from GLM, GAM, CART and ANN, since there is usually no single model that provides the best predictions for each species (see also Thuiller *et al.* 2005). Brotons *et al.* (2004) concluded that methods that use presence-absence perform better in general than methods that use presence-only data by comparing GLM to ENFA. In evaluating seven modelling approaches, Segurado and Araújo (2004) reached similar conclusions that no single approach was always the best, although ANN (using presence-absence) was generally better and ENFA and DOMAIN (using presence-only data) performed poorer. They offer a more detailed discussion on how users could choose between the various models, in choosing between automated data-driven processes such as BIOMOD or GARP, and models with well-known assumptions, such as GLM or ENFA. The approach of showing results for different models and allowing the reader to compare the results is also a worthwhile approach (e.g., McClean *et al.* 2005).

Various studies show that including information on vegetation together

with other explanatory variables increases the accuracy of predictions where a species occurs (e.g., Stockwell and Peterson 2002, 2003, Brotons *et al.* 2004, Segurado and Araújo 2004, Guisan *et al.* 2006). Although vegetation has no direct influence on occurrence of species (as there is a theoretical difference between the structure and the composition of vegetation types; for instance, species could be randomly distributed over physiognomically-defined vegetation types, and only height and cover of vegetation types could be influenced by environmental factors), information on vegetation provides some information on some of the factors that influence the occurrence of species. For example, Soberón and Peterson (2005) list abiotic factors (such as climate and soils), biotic factors (interactions with other species, such as seed dispersers, pollinators, competitors or diseases; see also Arnold and Asquith 2002, Dupre and Ehrlén 2002, Wilson 1999, Catherine *et al.* 2006, Orrock *et al.* 2006), landscape configuration (see also Grashof-Bokdam 1997, Aldrich and Hamrick 1998, Bawa 2001, Benítez-Malvido and Martínez-Ramos, 2003a,b, Jacquemyn *et al.* 2003) and the evolutionary capacity to adapt to change (see also Huenneke 1991, Müller-Starck 1995, Young and Boyle 2000) as different categories of factors that influence the distribution of a species. Mueller-Dombois and Ellenberg (1974) list habitat (all environmental factors, including climate, soil, topography and disturbance), flora and characteristics of plants (including ability to compete), accessibility (dispersal and establishment) and time (including time for evolution) as causal factors for vegetation types. Austin (2005) also lists abiotic (such as rainfall or soil nitrogen) and biotic (such as competition) factors as those that influence vegetation types.

Since there is some correspondence between the distribution of species and vegetation types, it makes sense to provide species lists for vegetation types (e.g. White 1983a, WWF 2005, tables 2-5), to list vegetation types for a particular species (e.g., Beentje 1994), to calculate the total number of species or species turnover for ecoregions (e.g. White 1983a, Kier *et al.* 2005), or to determine the vegetation type from information on taxonomic composition (e.g. Jolly *et al.* 1998, Elenga *et al.* 2000, Bongers *et al.* 2004).

Box and Fujiwara (2005) mention that mapping of potential vegetation and ecosystems must be based primarily on climate as it has overriding control on their distribution, and that their mapping only has problems for areas with unusual soil conditions. They list annual precipitation, annual potential evapotranspiration, mean temperature of the warmest month, absolute minimum temperature and mean minimum temperature of the coldest month as factors that determine vegetation structure. Prentice *et al.* (1992) include some other factors such as growing degree days and the ratio between actual evapotranspiration and equilibrium evapotranspiration as the environmental constraints for global biomes.

Ideally, we would have modelled the distribution of each species (using occurrence data and including information from the vegetation maps as explanatory variables), and would then have compared the species distribution (suitability maps) for each species with the distribution of the potential natural vegetation types (vegetation maps). Due to limited availability of occur-

rences (Table 1), it was not possible to generate accurate distribution maps for most species. It may be worthwhile, however, to construct distribution maps for the two species that had more than 20 occurrences (a criterion for sufficient occurrence data, see below) and use these two species as test cases for the accuracy of the vegetation maps.

Some authors (Stockwell and Peterson 2002, McClean *et al.* 2005) have argued to use all available occurrence data as calibration data while not reserving any data as validation data for those species that have small datasets. We think that testing the accuracy of a model is fundamental and that the users of the maps should be given some statistics on the accuracy of the map (which require some validation data). If users insist in having distribution maps for those species with limited information on their occurrences, we strongly suggest that these maps are accompanied by the positions of these occurrences so that users can get an idea of the level of extrapolation that was involved in obtaining the map and can make visual comparisons between the positions of the occurrence data and the modelled species distribution.

Guisan *et al.* (2006) suggest that species with limited information (< 20 occurrences) can only be modelled through simple approaches (such as climatic envelopes), by modelling more common species or by modelling communities. The latter approaches require previous studies on communities or common species with which the rare species are associated, and this requires extensive floristic information (Ferrier *et al.* 2002a,b). Since none of these approaches can substitute for obtaining additional occurrence information, additional sampling schemes may be required such as those suggested by Guisan *et al.* (2006).

4.3 The use of vegetation maps to select indigenous tree species for particular locations

Although vegetation maps can be used to document the distribution of species, vegetation maps are not necessarily correct for all species (Olson *et al.* 2001). No single biogeographic framework is optimal for all taxa but provides a compromise for as many taxa as possible, and ecoregions contain some habitats that differ from the assigned biome (Whittaker 1978, Olson *et al.* 2001). That vegetation maps do not provide the distribution for all species is also shown by the criterion of 50% of endemism (and not 100%) used as a criterion for African phytochoria (White 1983a). It has to be pointed out as well that the correspondence between vegetation and climate is not completely known. Global models therefore do not give predictions of climate that are valid everywhere (Prentice *et al.* 1992).

We want to make it very clear that there may be several limitations to the use of the new PNV maps to select indigenous tree species, although we do not want to imply that we disagree with our earlier statement that PNV maps have much to offer to agroforestry.

One of the limitations is that some site conditions may have changed so much that it is not possible to grow a particular species in a place at present, although the species was growing there before. This may have to do with changes in climatic conditions (the climate of Africa has undergone several cycles, see for example Olago (2001) or Nicholson (2001)), soil degradation (Aide and Cavellier 1994, McGrath *et al.* 2001, Uhl *et al.* 1982, Holl 1999, Friedel 1991), limits to regeneration due to absence of propagules because of either the distance to sources or constraints of pollinators and seed dispersal vectors (Asquith 1997, Camargo *et al.* 2002, Duncan and Colin 1999, Holl 1998a, 1999, Boshier 2004), altered competitive processes including competition with invasive species (Holl 1998b, Moore 2005, Yelenik *et al.* 2004), frequent and intense perturbation by fire (Walters *et al.* 2004, Uhl and Kaufman 1990, Nepstad *et al.* 1999), pollution (Ashmore 1997) or the effect of the altered microclimate on plant behaviour (Bell and Lechowicz 1994; Holl 1999). In particular in closed forest types, many plant species require different degrees of shade to regenerate and can not establish themselves in open degraded landscapes (Hubbell 1998). Often vegetation and environmental conditions are some kind of chicken-or-egg situation: the vegetation creates the environmental conditions that favour the persistence of the vegetation types (Bounoua *et al.* 2002, Foley *et al.* 2000, Ganopolski *et al.* 1998, Brovkin *et al.* 2003; Pielke *et al.* 1998), although ecosystems are also dynamic systems that undergo natural disturbances that are required for their survival (e.g. Watt 1947; Ashton, 1978; Hartshorn 1978; Whitmore 1978; Pickett and Cadenasso 1995). That the present conditions do not favour the regeneration of a particular species does not mean that the species – and therefore the vegetation type – may never come back to a certain area. We recommend that closer attention is paid to the ecosystem restoration literature in finding out how vegetation can be brought closer to original types. There is also a long tradition and experience of forest management and plantation establishment of how to establish or regenerate natural vegetation and shade tolerant species in mixed plantations to be utilised from both temperate areas (e.g. Röhrig *et al.*, 2006) and tropical forestry (e.g. Troup 1928, Dawkins and Phillips 1998, Lamprecht 1989).

Another limitation is conceptual: the range where a species occurs may only in part overlap with the range where a certain vegetation type occurs. A wide suite of statistical methods have recently been developed to test for these assumptions (see above), but given the limited data that was available on the distribution of indigenous species we were not able to statistically test this assumption at this point. The fact that species-specific distribution data is not readily available was actually the reason that we turned to the vegetation maps – where details are provided on the spatial distribution – to provide some information on where we expect that species can grow. The reverse may also be true: that a species occurs in a wide range of vegetation types. The description of the vegetation of Africa mentioned that it is difficult to distinguish between various forest parts due to the large environmental tolerance of species (White 1983a). The fact that species may occur in several vegetation types is illustrated by *Juniperus procera*. This species dominates the driest montane forest types, but also occurs in other dry montane forest types, in dry intermediate forest and in semi-evergreen

bushland. White (1983a) expects that the semi-evergreen bushland is actually the natural habitat for this species. The general experience with plantation species is that important genetic variation is most likely to exist between populations of plant species that cover large or environmentally heterogeneous distribution areas. Studies from tropical, subtropical and temperate areas have confirmed this picture for a large number of tree species by revealing genetic variation in key quantitative traits (von Bothmer and Seberg 1995, Guarino 1995). Genetic variation has not only been observed in survival and growth rates of plantings but also in the quantity and quality of their end products (Mouna 1990, Mandal and Gibson 1998, Zobel and Jett 1995, Zobel *et al.* 1987).

Where a species occurs in several vegetation types, we warn against transferring seeds or other planting materials from one vegetation type to another. When trees are planted outside their native environment, there is no guarantee that they will grow well (Vinceti *et al.* 2004). In some situations, there may be no problems with such transfers. Without having tested such transfers, we simply do not know. In such cases it is better to adhere to the safety principal. That is, for those who can not take the risk, it is safest to use local seed sources with »local« meaning that they are from the same vegetation (Kindt *et al.* 2006).

The third limitation is closely related to the second one: by classifying vegetation in a limited number of types, some information on the natural variation in vegetation is lost. Not all boundaries between vegetation types are abrupt and in many situations do ecotones exist between the vegetation types (see above). One should therefore not interpret the map in being completely homogeneous within vegetation types. Being limited in the number of classes that can be portrayed is actually an inherent feature of a map – and being a meaningful summary of reality can also be a useful feature for a tool that has primarily been designed as an extension tool. The user should be aware that ecoregions rarely form abrupt edges but are bound by ecotones and mosaic habitats, however.

5. Conclusion/Recommendations

As the authors of the original vegetation maps provided limited information on the methods that they used to produce their maps (they did not list criteria or species lists for the different vegetation types), we consulted other literature and herbarium information to obtain species lists for each vegetation type. This information allowed to confirm a floristic differentiation between the mapped vegetation types and provided species lists for each vegetation type. By combining this information with information on uses (available for a subset of species), it is now possible to get a list of candidate species that can be planted for a particular purpose in a particular area of the map.

In the discussion section, we highlighted that there are several limitations to the approach of using vegetation maps to provide information on the suitability of particular species, some that are related to the necessary abstraction level that a map provides (in the same way that no statistical model is ever 100% accurate, no map is ever 100% correct) and some that are related to limitations in knowledge on species distribution (which is the rationale to use vegetation maps as a proxy for species distribution). Given that we only obtained a limited dataset on occurrences for most of the indigenous tree species that we investigated, a recommended way forward is to increase these datasets. Such larger datasets can then be used to construct suitability maps for particular species, test hypotheses about the accuracy of the boundaries on the map or its ecotone widths, and investigate floristic differences between vegetation types (probably by constrained ordination analysis).

We recommend that users treat the information provided by the map cautiously – by using the map as a decision support tool and not as a decision making tool. For example, the list of species and their uses could be checked with key informants (such as long-term residents of the area, experienced extension workers, or experienced botanists, ecologists or foresters) or by a rapid survey of the target area. Before embarking on large-scale promotion, it may also be worthwhile to test species' growth and survival on a small scale first. Complementing the information with some economic or cultural analyses will also enrich the capability of selecting particular species for particular areas. Finally, although we did not dwell on the advantages of tree species diversity in terms of stability of production and the limitation of risks (complementing the biodiversity value of assemblages of indigenous tree species), we hope that the maps will be used to select several indigenous species for a particular area and not a silver-bullet single species that is expected to provide all products and services in a sustainable way.

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The species that are listed are those species for which information on uses was available for the various potential natural vegetation types. The table column refers to the expected reliability that the species could occur in certain vegetation type (rank 1 = highest expected reliability, rank 5 = lowest expected reliability; see methods).

1. Bamboo woodland and thicket

[illegible]

2. Moist montane forest

[illegible]

Species	Wood											Food									Fodder		Environmental							Other											
	Firewood	Charcoal	Timber/furniture/Construction	Poles/posts	Flooring	Veneer/plywood	Boat building	Beehives	Tools/Tool handles/Shafts	Carvings/Utensils/Walking stick/Bow/arrow	Farm Implements	Edible fruit/nuts/seed	Vegetable/edible leaves/edible roots	Seasoning/Flavouring	Drink/Soap	Edible oil/gum/inner bark	Jam/Syrup	Medicine	Fodder	Shade	Ornamenta/Avenue tree	Mulch	Nitrogen fixation	Soil conservation/soil improvement	River bank/sand stabilization	Windbreak	Fibre/weaving/rope	Thatch/roofing/Mats/Baskets	Resin/Gum/Glue/Latex	Tannin/Dye	Live fence/Dead fence	Ceremonial	Toothbrushes	Boundary marking	Veterinary medicine	Toxin/Insecticide/Repellent	Cosmetic/Soap/Perfume/Oil	Brooms			
<i>Ficus sur</i>	x		x					x		x		x						x	x	x	x	x								x											
<i>Ficus thonningii</i>	x											x								x	x									x											
<i>Garcinia volkensii</i>												x																													
<i>Hagenia abyssinica</i>	x	x	x	x						x								x																							
<i>Harungana madagascariensis</i>	x	x	x	x					x	x		x						x																							
<i>Ilex mitis</i>	x	x	x						x		x																														
<i>Macaranga kilimandscharica</i>	x	x	x	x														x																							
<i>Myrianthus holstii</i>	x									x		x																													
<i>Nuxia congesta</i>	x	x																x																							
<i>Ocotea kenyanensis</i>			x																																						
<i>Ocotea usambarensis</i>	x	x	x	x																																					
<i>Olea capensis</i>	x	x	x						x																																
<i>Olea europaea</i>	x	x	x	x						x		x																													
<i>Ozoroa insignis</i>	x	x	x	x																																					
<i>Podocarpus latifolius</i>	x		x	x						x																															
<i>Polyscias fulva</i>	x		x					x																																	
<i>Polyscias kikuyuensis</i>	x		x							x																															
<i>Prunus africana</i>	x	x	x	x						x																															
<i>Rapanea melanophloeos</i>																																									
<i>Rhus natalensis</i>	x	x	x																																						
<i>Sapium ellipticum</i>	x	x	x						x																																
<i>Schefflera volkensii</i>	x		x																																						
<i>Strombosia scheffleri</i>	x	x	x							x																															

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Other	Brooms								
	Cosmetic/Soap/Perfume/Oil								
	Toxin/Insecticide/Repellent								
	Veterinary medicine			x					
	Boundary marking								
	Toothbrushes								
	Ceremonial								
	Live fence/Dead fence								
	Tannin/Dye		x						
	Resin/Gum/Glue/Latex								
	Thatch/roofing/Mats/Baskets								
	Fibre/weaving/rope								
Environmental	Windbreak					x			
	River bank/sand stabilization								
	Soil conservation/soil improvement								
	Nitrogen fixation								
	Mulch	x							
	Ornamenta/Avenue tree					x			
	Shade	x				x			
Fodder	Bee forage		x						
	Fodder								
Food	Medicine		x	x			x		
	Jam/Syrup								
	Edible oil/gum/inner bark								
	Drink/Soap								
	Seasoning/Flavouring								
	Vegetable/edible leaves/edible roots								
	Edible fruit/nuts/seed	x	x			x			
Wood	Farm Implements								
	Carvings/Utensils/Walking stick/Bow/arrow	x			x				
	Tools/Tool handles/Shfts		x	x					
	Beehives								
	Boat building								
	Veneer/plywood					x			
	Flooring								
	Poles/posts	x	x	x	x	x			
	Timber/furniture/Construction	x	x	x	x	x	x	x	
	Charcoal	x	x	x	x		x		
	Firewood	x	x	x	x	x	x		
	Table	2	2	2	2	2	2	2	
Species		<i>Synsepalum brevipes</i>	<i>Syzgium guineense</i>	<i>Teclea nobilis</i>	<i>Vitex keniensis</i>	<i>Zanthoxylum gillettii</i>	<i>Zanthoxylum rubescens</i>		

3. Dry montane forest

Species		Wood											Food							Fodder		Environmental							Other																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
		Firewood	Charcoal	Timber/furniture/Construction	Poles/posts	Flooring	Veneer/plywood	Boat building	Beehives	Tools/Tool handles/Shafter	Carvings/Utensils/Walking stick/Bow/arrow	Farm Implements	Edible fruit/nuts/seed	Vegetable/edible leaves/edible roots	Seasoning/Flavouring	Drink/Soap	Edible oil/gum/inner bark	Jam/Syrup	Medicine	Fodder	Bee forage	Shade	Ornamenta/Avenue tree	Mulch	Nitrogen fixation	Soil conservation/soil improvement	River bank/sand stabilization	Windbreak	Fibre/weaving/rope	Thatch/roofing/Mats/Baskets	Resin/Gum/Glue/Latex	Tannin/Dye	Live fence/Dead fence	Ceremonial	Toothbrushes	Boundary marking	Veterinary medicine	Toxin/Insecticide/Repellent	Cosmetic/Soap/Perfume/Oil	Brooms																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
<i>Acacia abyssinica</i>	2	x	x		x														x	x	x	x	x																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
<i>Acacia drepanolobium</i>	1	x	x													x			x	x	x	x																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
<i>Acacia gerrardii</i>	1	x	x	x	x					x						x			x	x	x	x																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				

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Species		Wood											Food							Fodder		Environmental							Other																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
		Firewood	Charcoal	Timber/furniture/Construction	Poles/posts	Flooring	Veneer/plywood	Boat building	Beehives	Tools/Tool handles/Shfts	Carvings/Utensils/Walking stick/Bow/arrow	Farm Implements	Edible fruit/nuts/seed	Vegetable/edible leaves/edible roots	Seasoning/Flavouring	Drink/Soap	Edible oil/gum/inner bark	Jam/Syrup	Medicine	Edible fruit/nuts/seed	Edible fruit/nuts/seed	Fodder	Bee forage	Shade	Ornamenta/Avenue tree	Mulch	Nitrogen fixation	Soil conservation/soil improvement	River bank/sand stabilization	Windbreak	Fibre/weaving/rope	Thatch/roofing/Mats/Baskets	Resin/Gum/Glue/Latex	Tannin/Dye	Live fence/Dead fence	Ceremonial	Toothbrushes	Boundary marking	Veterinary medicine	Toxin/Insecticide/Repellent	Cosmetic/Soap/Perfume/Oil	Brooms																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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4. Moist intermediate forest

Species	Table	Wood										Food							Fodder		Environmental							Other		
		Farm Implements										Medicine							Bee forage		Windbreak									
<i>Acacia lahai</i>	4	Carvings/Utensils/Walking stick/Bow/arrow										Jam/Syrup							Fodder		River bank/sand stabilization									
<i>Albizia gummifera</i>	2	Tools/Tool handles/Shafes										Edible oil/gum/inner bark									Soil conservation/soil improvement									
<i>Albizia zygia</i>	2	Beehives										Drink/Soap									Nitrogen fixation									
<i>Antiaris toxicaria</i>	2	Boat building										Seasoning/Flavouring									Mulch									
<i>Apodytes dimidiata</i>	3	Veneer/plywood										Vegetable/edible leaves/edible roots									Ornamenta/Avenue tree									
<i>Besana abyssinica</i>	2	Flooring										Edible fruit/nuts/seed									Shade									
<i>Blighia unijugata</i>	2	Poles/posts																												
<i>Blighia micrantha</i>	2	Timber/furniture/Construction																												
<i>Bridelia micrantha</i>	2	Charcoal																												
<i>Carissa edulis</i>	4	Firewood																												
<i>Casaeria battiscombei</i>	2																													
<i>Cassipourea malosana</i>	2																													
<i>Cassipourea ruwensorensis</i>	2																													
<i>Chrysophyllum albidum</i>	2																													
<i>Combretum molle</i>	4																													
<i>Cordia africana</i>	2																													
<i>Groton macrostachyus</i>	2																													
<i>Groton megalocarpus</i>	1																													
<i>Groton sylvaticus</i>	2																													
<i>Diospyros abyssinica</i>	2																													
<i>Dracaena steudneri</i>	2																													
<i>Ehretia cymosa</i>	2																													
<i>Ekebergia capensis</i>	2																													
<i>Erythrina abyssinica</i>	3																													

Species	Table	Wood										Food										Fodder		Environmental							Other																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
		Firewood	Charcoal	Timber/furniture/Construction	Poles/posts	Flooring	Veneer/plywood	Boat building	Beehives	Tools/Tool handles/Shafts	Carvings/Utensils/Walking stick/Bow/arrow	Farm Implements	Edible fruit/nuts/seed	Vegetable/edible leaves/edible roots	Seasoning/Flavouring	Drink/Soap	Edible oil/gum/inner bark	Jam/Syrup	Medicine	Edible fruit/nuts/seed	Vegetable/edible leaves/edible roots	Seasoning/Flavouring	Drink/Soap	Edible oil/gum/inner bark	Jam/Syrup	Medicine	Fodder	Bee forage	Shade	Ornamenta/Avenue tree	Mulch	Nitrogen fixation	Soil conservation/soil improvement	River bank/sand stabilization	Windbreak	Fibre/weaving/rope	Thatch/roofing/Mats/Baskets	Resin/Gum/Glue/Latex	Tannin/Dye	Live fence/Dead fence	Ceremonial	Toothbrushes	Boundary marking	Veterinary medicine	Toxin/Insecticide/Repellent	Cosmetic/Soap/Perfume/Oil	Brooms																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
<i>Fagaropsis angolensis</i>		x																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																	</

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Species	Wood											Food							Fodder		Environmental						Other																				
	Firewood	Charcoal	Timber/furniture/Construction	Poles/posts	Flooring	Veneer/plywood	Boat building	Beehives	Tools/Tool handles/Shafter	Carvings/Utensils/Walking stick/Bow/arrow	Farm Implements	Edible fruit/nuts/seed	Vegetable/edible leaves/edible roots	Seasoning/Flavouring	Drink/Soap	Edible oil/gum/inner bark	Jam/Syrup	Medicine	Fodder	Fodder	Shade	Ornamenta/Avenue tree	Mulch	Nitrogen fixation	Soil conservation/soil improvement	River bank/sand stabilization	Windbreak	Fibre/weaving/rope	Thatch/roofing/Mats/Baskets	Resin/Gum/Glue/Latex	Tannin/Dye	Live fence/Dead fence	Ceremonial	Toothbrushes	Boundary marking	Veterinary medicine	Toxin/Insecticide/Repellent	Cosmetic/Soap/Perfume/Oil	Brooms								
<i>Podocarpus falcatus</i>	x		x	x		x												x			x																										
<i>Polyscias fulva</i>	x		x				x			x									x					x																							
<i>Premna angolensis</i>			x																																												
<i>Premna maxima</i>			x																																												
<i>Prunus africana</i>	x	x	x	x						x								x				x							x																		
<i>Rapanea melanophloeos</i>			x															x																													
<i>Rauvolfia caffra</i>	x		x					x		x									x																												
<i>Rhus natalensis</i>	x	x	x									x						x																													
<i>Sapium ellipticum</i>	x	x	x						x									x																													
<i>Sesbania sesban</i>	x	x		x															x																												
<i>Spathodea campanulata</i>	x	x								x									x																												
<i>Strombosia scheffleri</i>	x	x	x																																												
<i>Syagium cordatum</i>	x	x	x					x				x																																			
<i>Syagium guineense</i>	x	x	x	x					x			x																																			
<i>Teclea nobilis</i>	x	x	x	x																																											
<i>Trema orientalis</i>	x	x		x																																											
<i>Trichilia emetica</i>	x		x	x																																											
<i>Vangueria infausta</i>	x											x																																			
<i>Vernonia amygdalina</i>	x												x																																		
<i>Vitex doniana</i>	x	x	x	x																																											
<i>Warburgia ugandensis</i>	x		x																																												
<i>Zanthoxylum gillettii</i>	x	x	x																																												
<i>Zanthoxylum mildbraedii</i>			x																																												
<i>Zanthoxylum rubescens</i>			x																																												
<i>Ziziphus abyssinica</i>	x	x	x	x								x																																			

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continued

Species		Wood												Food							Fodder		Environmental							Other											
		Firewood	Charcoal	Timber/furniture/Construction	Poles/posts	Flooring	Veneer/plywood	Boat building	Beehives	Tools/Tool handles/Shanks	Carvings/Utensils/Walking stick/Bow/arrow	Farm Implements	Edible fruit/nuts/seed	Vegetable/edible leaves/edible roots	Seasoning/Flavouring	Drink/Soap	Edible oil/gum/inner bark	Jam/Syrup	Medicine	Fodder	Shade	Ornamenta/Avenue tree	Mulch	Nitrogen fixation	Soil conservation/soil improvement	River bank/sand stabilization	Windbreak	Fibre/weaving/rope	Thatch/roofing/Mats/Baskets	Resin/Gum/Glue/Latex	Tannin/Dye	Live fence/Dead fence	Ceremonial	Toothbrushes	Boundary marking	Veterinary medicine	Toxin/Insecticide/Repellent	Cosmetic/Soap/Perfume/Oil	Brooms		
<i>Ficus thonningii</i>	2	x										x							x		x	x							x												
<i>Juniperus procera</i>	3	x	x	x	x	x		x											x																	x					
<i>Kigelia pinnata</i>	4	x	x	x	x			x		x						x																									
<i>Lepisanthes senegalensis</i>	3	x	x	x	x				x	x		x																													
<i>Manilkara discolor</i>	2											x																													
<i>Margaritaria discoidea</i>	2	x	x	x	x													x																							
<i>Markhamia lutea</i>	2	x	x	x	x			x																																	
<i>Mimusops kummel</i>	2	x	x	x				x	x	x		x																													
<i>Newtonia buchananii</i>	4	x		x																																					
<i>Nuxia congesta</i>	2	x	x																																						
<i>Olea capensis</i>	3	x	x	x					x																																
<i>Olea europaea</i>	2	x	x	x	x	x				x		x																													
<i>Ozoroa insignis</i>	3	x	x	x																																					
<i>Podocarpus falcatus</i>	4	x		x	x																																				
<i>Rauvolfia caffra</i>	4	x		x				x		x																															
<i>Rhus natalensis</i>	3	x	x	x								x																													
<i>Sapium ellipticum</i>	2	x	x	x					x																																
<i>Schrebera alata</i>	2	x	x																																						
<i>Sesbania sesban</i>	4	x																																							
<i>Strychnos henningsii</i>	2				x							x																													
<i>Strychnos mitis</i>	2	x	x	x	x																																				
<i>Syzygium cordatum</i>	4	x	x	x				x				x																													
<i>Teclea nobilis</i>	2	x	x	x	x				x																																
<i>Trema orientalis</i>	2	x	x		x																																				
<i>Vangueria infausta</i>	4	x			x				x			x																													
<i>Vangueria madagascariensis</i>	4	x										x																													
<i>Warburgia ugandensis</i>	2	x		x								x																													

6. Upland *Acacia* woodland, savanna and bushland

Species	Wood											Food							Fodder		Environmental							Other				Other																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
	Table	Firewood	Charcoal	Timber/furniture/Construction	Poles/posts	Flooring	Veneer/plywood	Boat building	Beehives	Tools/Tool handles/Shfts	Carvings/Utensils/Walking stick/Bow/arrow	Farm Implements	Edible fruit/nuts/seed	Vegetable/edible leaves/edible roots	Seasoning/Flavouring	Drink/Soap	Edible oil/gum/inner bark	Jam/Syrup	Medicine	Fodder	Bee forage	Shade	Ornamenta/Avenue tree	Mulch	Nitrogen fixation	Soil conservation/soil improvement	River bank/sand stabilization	Windbreak	Fibre/weaving/rope	Thatch/roofing/Mats/Baskets	Resin/Gum/Glue/Latex	Tannin/Dye	Live fence/Dead fence	Ceremonial	Toothbrushes	Boundary marking	Veterinary medicine	Toxin/Insecticide/Repellent	Cosmetic/Soap/Perfume/Oil	Brooms																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
<i>Acacia brevispica</i>	1	x																	x		x																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					</

7. Lowland *Acacia-Commiphora* woodland, bushland and thicket

[illegible]

[illegible]

8. Dry *Combretum* savanna

Species	Wood										Food							Fodder		Environmental						Other																				
	Table	Firewood	Charcoal	Timber/furniture/Construction	Poles/posts	Flooring	Veneer/plywood	Boat building	Beehives	Tools/Tool handles/Shafts	Carvings/Utensils/Walking stick/Bow/arrow	Farm Implements	Edible fruit/nuts/seed	Vegetable/edible leaves/edible roots	Seasoning/Flavouring	Drink/Soap	Edible oil/gum/inner bark	Jam/Syrup	Medicine	Fodder	Fodder	Shade	Ornamenta/Avenue tree	Mulch	Nitrogen fixation	Soil conservation/soil improvement	River bank/sand stabilization	Windbreak	Fibre/weaving/rope	Thatch/roofing/Mats/Baskets	Resin/Gum/Glue/Latex	Tannin/Dye	Live fence/Dead fence	Ceremonial	Toothbrushes	Boundary marking	Veterinary medicine	Toxin/Insecticide/Repellent	Cosmetic/Soap/Perfume/Oil	Brooms						
<i>Acacia senegal</i>	4	x	x		x					x							x		x	x	x	x				x																				
<i>Acacia seyal</i>	4	x	x		x											x				x	x																									
<i>Azanza garckeana</i>	4	x	x	x						x			x				x				x																									
<i>Boscia angustifolia</i>	4									x																																				
<i>Cadaba farinosa</i>	4	x												x						x																										
<i>Carissa edulis</i>	4	x											x							x																										
<i>Combretum aculeatum</i>	4	x											x							x																										
<i>Combretum collinum</i>	3	x	x		x															x																						x				
<i>Combretum molle</i>	3	x	x	x	x															x																										
<i>Commiphora africana</i>	3	x											x							x																										
<i>Cordia africana</i>	4	x		x					x				x							x																										
<i>Dichrostachys cinerea</i>	4	x								x											x																									
<i>Ekebergia capensis</i>	4	x	x		x															x																										
<i>Erythrina abyssinica</i>	4	x		x					x											x																										
<i>Faurea saligna</i>	1	x	x	x	x															x																										
<i>Flacourtia indica</i>	4	x	x	x	x								x							x																										
<i>Senna singueana</i>	4																																													
<i>Stereospermum kunthianum</i>	4	x	x		x					x										x																										
<i>Strychnos spinosa</i>	4	x	x										x							x																										
<i>Terminalia brownii</i>	3	x	x	x	x					x										x																										
<i>Vangueria madagascariensis</i>	4	x			x					x			x																																	
<i>Vitex payos</i>	4	x			x					x			x																																	
<i>Ziziphus abyssinica</i>	4	x	x		x								x																																	

9. Moist *Combretum-Termindia* savanna

[illegible]

continued

Species	Table	Wood	Food	Fodder	Environmental	Other												
							Brooms	Cosmetic/Soap/Perfume/Oil	Toxin/Insecticide/Repellent	Veterinary medicine	Boundary marking	Toothbrushes	Ceremonial	Live fence/Dead fence	Tannin/Dye	Resin/Gum/Glue/Latex	Thatch/roofing/Mats/Baskets	Fibre/weaving/rope
<i>Maytenus senegalensis</i>	3							x						x				
<i>Milicia excelsa</i>	3												x					
<i>Parinari curatellifolia</i>	3																	
<i>Piliostigma thonningii</i>	3													x	x			
<i>Rhus natalensis</i>	4											x			x			
<i>Sapium ellipticum</i>	4																	
<i>Securidaca longepedunculata</i>	3								x									x
<i>Senna singuana</i>	4														x			
<i>Stereospermum kunthianum</i>	3																	
<i>Strychnos madagascariensis</i>	3																	
<i>Strychnos spinosa</i>	3											x						
<i>Syzygium guineense</i>	3														x			
<i>Terminalia mollis</i>	3																	
<i>Vitex doniana</i>	3														x			
<i>Ziziphus abyssinica</i>	4														x			x

10. Evergreen and semi-evergreen bushland

[illegible]

continued

Species	Food																								Fodder		Environmental							Other						
	Edible fruit/nuts/seed	Vegetable/edible leaves/edible roots	Seasoning/Flavouring	Drink/Soap	Edible oil/gum/inner bark	Jam/Syrup	Medicine	Fodder	Fodder	Shade	Ornamenta/Avenue tree	Mulch	Nitrogen fixation	Soil conservation/soil improvement	River bank/sand stabilization	Windbreak	Fibre/weaving/rope	Thatch/roofing/Mats/Baskets	Resin/Gum/Glue/Latex	Tannin/Dye	Live fence/Dead fence	Ceremonial	Toothbrushes	Boundary marking	Veterinary medicine	Toxin/Insecticide/Repellent	Cosmetic/Soap/Perfume/Oil	Brooms												
<i>Dracaena ellenbeckiana</i>																																								
<i>Elaeodendron buchananii</i>																																								
<i>Euclea divinorum</i>																																								
<i>Euclea racemosa</i>																																								
<i>Euphorbia candelabrum</i>																																								
<i>Euphorbia tirucalli</i>																																								
<i>Flacourtia indica</i>																																								
<i>Grewia temberensis</i>																																								
<i>Juniperus procera</i>																																								
<i>Olea europaea</i>																																								
<i>Rhus natalensis</i>																																								
<i>Schrebera alata</i>																																								
<i>Scutia myrtina</i>																																								
<i>Senna singueana</i>																																								
<i>Tarconanthus camphoratus</i>																																								
<i>Vangueria</i>																																								
<i>madagascariensis</i>																																								

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12. *Acacia* and allied vegetation on soils with impeded drainage

[illegible]



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**Development and
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**Danish Centre for Forest,
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